DEPARTMENT OF THE INTERIOR
UNITED STATES RECLAMATION SERVICE

MEASUREMENT *of* IRRIGATION WATER

WASHINGTON
GOVERNMENT PRINTING OFFICE
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MEASUREMENT OF IRRIGATION WATER.

INTRODUCTORY STATEMENT.

1. *Importance of measurement.*—Accurate measurement of irrigation water is of fundamental importance to good irrigation management. A perfect understanding of some of the primary principles relating to the subject of water measurement is therefore necessary. For the purpose of furthering an understanding of these principles and for the purpose of having information and tables on the subject convenient for field use, this booklet was compiled in 1913 by F. W. Hanna.[1]

2. *General units of measurement.*—The units of measurement at present employed in irrigation practice in the West are the miner's inch, the second-foot, and the acre-foot. The miner's inch is not a definite unit, varying as to quantity in the different States. Fifty miner's inches are equivalent to 1 second-foot in Idaho, Kansas, Nebraska, New Mexico, North Dakota, and South Dakota. In Arizona, California, Montana, and Oregon, 40 miner's inches are equivalent to 1 second-foot, while in Colorado, 38.4 miner's inches are equivalent to 1 second-foot. A second-foot is that unit of flow that will produce 1 cubic foot of volume in one second of time. An acre-foot is that unit of quantity required to cover 1 acre of land 1 foot in depth. It should be noted that the element of time enters into the miner's inch and into the second-foot, but that the acre-foot does not involve the element of time.

3. *Units of measure adopted.*—Owing to the fact that the miner's inch, made definite by the use of the second-foot as a unit, has a different value in different States, it is an undesirable unit of measure to use, and the service has adopted the second-foot as the unit of measure where flow is considered. Owing to convenience of size and its particular application to land areas, the acre-foot has been adopted as the unit of measure where volume is considered independently of time.

4. *Kinds of measuring devices.*—In the measurement of irrigation water the service has adopted weirs, submerged orifices, and current-meter gaging stations. Where there is sufficient available fall, and the quantity of water to be measured is not too large, the most serviceable and economical measuring device that can be used is the weir; where there is little available fall, the quantity of water is small

[1] The text of the 1913 edition has been used unchanged.

and there is not too much floating débris, the submerged orifice is applicable; where the quantity of water is large and there is not available sufficient fall for the use of a weir, current-meter gaging stations are applicable. These three methods of measuring irrigation water are, therefore, supplemental to one another in covering the entire field of need.

PART I. WEIRS.

5. *Definition and classification of weirs.*—A weir may be defined as a notch in the top of a vertical wall through which water flows. The determination of the quantity of water that will flow through such a notch under specific conditions depends upon experimental data taken in connection with the cross-sectional area of the discharge sheet through the notch. The weirs generally employed for the measurement of irrigation water are the trapezoidal weir of the Cippoletti type and the rectangular weir. Each of these types may again be divided into free weirs and submerged weirs. The free weir is one in which the water elevation on the downstream side of the weir does not reach up to the elevation of the weir crest. The submerged weir is one in which the water elevation on the downstream side of the weir rises to an elevation above the crest of the weir. Weirs are also classified as suppressed or contracted weirs. The contracted weir is one with its sides so far removed from the sides of the channel that the filaments of water are fully contracted as the water passes through the weir. The suppressed weir is one with its sides coincident with the sides of the channel, so that the filaments of water pass through the weir without being deflected from their normal course.

6. *Types of weirs adopted.*—The type of weirs adopted by the service for the measurement of irrigation water are the sharp-crested and sharp-sided contracted rectangular weir, the sharp-crested suppressed rectangular weir, and the sharp-crested and sharp-sided Cippoletti weir. These three types of weir will be hereinafter designated, respectively, as the standard contracted rectangular weir, the standard suppressed rectangular weir, and the standard Cippoletti weir. It is the aim of the service to use these weirs without submergence, although there may be cases where it will be necessary to permit submergence for short periods at least.

7. *Definition and conditions for accuracy of standard contracted rectangular weirs.*—A standard contracted rectangular weir is a rectangular weir with its crest and sides consisting of a thin-edged plate and so far removed, respectively, from the bottom and sides of the leading channel as to cause the filaments of water to be fully deflected from their normal course. The deflection is approximately the maximum deflection that would obtain with the crest and sides of the weir at unlimited distances from the channel boundaries.

The crest and sides may be made of planks if the upstream edges are definite rectangular corners, but it is best to use a thin metal plate. Several extended series of experiments have been conducted for determining the proper coefficient to apply to the contracted weir of the type here discussed and to establish conditions that insure perfect contraction. As a result of these experiments, the following conditions are considered necessary for accuracy of measurements:

(*a*) The upstream crest and side edges of the weir should be sharp and smooth, and the distance of the crest and sides respectively from the bottom and sides of the leading channel should preferably be not less than twice the depth of water on the weir, and in no case be less than 1 foot.

(*b*) The overflowing sheet should touch only the upstream edges of the crest and sides.

(*c*) Air should circulate freely both under and on the sides of the overflowing sheet.

(*d*) The upstream face of the weir should be vertical.

(*e*) The crest should be level from end to end.

(*f*) The sides should be truly vertical.

(*g*) The measurement of head on the weir should be the actual elevation of the water surface above the level of the weir crest, and should be taken from 4 to 10 feet upstream from the weir.

(*h*) The cross-sectional area of the leading channel for 20 to 30 feet upstream from the weir should be at least six times that of the overflowing sheet at the weir crest.

(*i*) Corrections should be made for velocity of approach where appreciable errors are caused by neglecting the head due to it.

8. *Formulas for standard contracted rectangular weir.*—Two widely used formulas for computing the discharges over standard contracted rectangular weirs are those of Hamilton Smith and J. B. Francis. The formulas proposed by Hamilton Smith require the use of coefficients of discharge varying with the head of water on the weir, and also with the length of weir, which makes them somewhat inconvenient, although they are accurate for the ranges of coefficients usually given. The Francis formula for this type of weir without velocity of approach is as follows:

$$(1) \quad Q = 3.33 H^{\frac{3}{2}} (L - 0.2 H);$$

and with velocity of approach is as follows:

$$(2) \quad Q' = 3.33[(H+h)^{\frac{3}{2}} - h^{\frac{3}{2}}] (L - 0.2 H);$$

in which Q is the discharge in second-feet without velocity of approach; Q' the discharge in second-feet with velocity of approach; L the length of weir, in feet; H the head on the weir, in feet; and h the head due to velocity of approach, in feet. It will be noted that the Francis formulas contain constant discharge coefficients,

which make computations by them easy without the use of tables. The Francis experiments were made on comparatively large weirs, most of them 10 feet long, with heads ranging from 0.4 to 1.6 feet, so that the formulas apply particularly to such weirs rather than to short weirs with low heads. Experiments on 6-inch, 1-foot, 2-foot, and 3-foot weirs on the Boise project, Idaho, show that these formulas apply fairly well to shorter weirs, provided the head of water on the weir is not greater than about one-third the length of the weir. For a ratio of depth to length greater than this the actual discharges exceed those given by the formulas by an amount which increases gradually from about 0 per cent for a ratio of $\frac{1}{3}$ to about 30 per cent for a ratio of 1.

9. *Definition and conditions for accuracy of standard suppressed rectangular weir.*—A standard suppressed rectangular weir is a rectangular weir with its crest consisting of a thin plate so far removed from the bottom of the leading channel as to cause the filaments of water to be fully deflected from their normal course, and with its sides coincident with the sides of the leading channel, so that there is no change in direction laterally of the filaments of water passing through the weir. All conditions for accuracy of measurements for this type of weir are identical with those of the contracted rectangular weir, except those relating to side contraction. In the suppressed weir the sides of the leading channel should be coincident with the sides of the weir, and the over-falling sheet should not be allowed to expand immediately downstream from the weir. Special care must be taken in this type of weir to secure the proper aeration beneath the overflowing sheet below the crest.

10. *Formulas for standard suppressed rectangular weir.*—The two principal formulas used for computing the discharge of the standard suppressed rectangular weirs are also those of Smith and Francis. In the Smith formulas for suppressed weirs, as for contracted weirs, the coefficients of discharge vary with the head on the weir and with the length of the weir, so these formulas are not convenient for computations without the use of tables of coefficients. The law of these variations for the two types of weirs is different, so it is necessary to provide a separate table for each. The Francis formula for the standard suppressed rectangular weir without velocity of approach is as follows:

$$(3) \quad Q = 3.33 L H^{\frac{3}{2}};$$

and with velocity of approach is as follows:

$$(4) \quad Q' = 3.33 L \left[(H+h)^{\frac{3}{2}} - h^{\frac{3}{2}}\right].$$

In these formulas the letters have the same significance as in those for contracted weirs, and the coefficient of discharge was obtained by Francis from the same general set of experiments as those stated for

the contracted weir. No extensive tests have been made to determine the applicability of these formulas to weirs less than 4 feet in length.

11. *Definition and conditions for accuracy of standard Cippoletti weir.*—A standard Cippoletti weir is a trapezoidal weir with its crest and sides consisting of a thin plate, and so far removed from the bottom and sides of the leading channel as to cause the filaments of water to be deflected from their normal course and with its sides sloping outward as they rise in a ratio of 1 to 4. While this weir is necessarily a contracted weir, and should be so considered as far as requirements of installation are concerned, yet, in discharge effect, it is a suppressed weir. This is due to the fact that Cippoletti in his formula has allowed for the reducing effect in the discharge due to end contractions by making the sides of the weir sufficiently sloping to overcome this effect. All conditions for accuracy stated for the standard contracted rectangular weir apply to the Cippoletti weir except that of the slope of the sides.

12. *Formulas for standard Cippoletti weir.*—Theoretically the formula for the standard Cippoletti weir without velocity of approach should be the same as the Francis formula for the standard suppressed rectangular weir. Cippoletti, from his experiments, however, increased the Francis coefficient by about 1 per cent, so that his formula, without velocity of approach, is as follows:

$$(5)\quad Q=3.367\ LH^{\frac{3}{2}}.$$

The discharge for this weir with velocity of approach may be obtained from the following formula:

$$(6)\quad Q'=3.367\ L\ (H+1.5\ h)^{\frac{3}{2}}.$$

In these formulas the letters have the same significance as in the preceding formulas. The correction for velocity of approach may be applied as in the Francis formula also with fair results.

13. *Velocity of approach in weir measurements.*—So far as practicable weirs should be installed so as to make the velocity of approach negligible; but where it is impracticable to do this appropriate corrections should be made. Such corrections for the Francis formulas are difficult to make without the use of tables providing percentages of increase to apply to the computed discharges. In the formula given for use with the Cippoletti weir the correction can be applied to the measured head directly and the proper discharge readily obtained, or the discharge can be obtained as indicated by the Francis method and use of tables. Attention is called to the fact that moderate velocities of approach with low heads on the weir produce large errors, whereas comparatively high velocities of

approach with large heads on the weir produce relatively small errors. The velocity of approach may be computed from the following formula:

$$(7)\quad v=Q\div A;$$

in which v is the velocity of approach in feet per second, Q the discharge in second-feet, and A the cross-sectional area of the leading channel in square feet. The discharge may be computed by the appropriate weir formula without velocity of approach, with sufficient accuracy for determining v for ordinary cases. Successive approximations may be used to determine v to any desired degree of accuracy for special cases. Having obtained the value of v, the velocity of approach head may be computed from the following formula:

$$(8)\quad h=0.0156\ v^2.$$

After h has been computed from formula (8), the effective head, D, on the weir can be computed from the measured head, H, by means of the following formula:

$$(9)\quad D=\left[(H+h)^{\frac{3}{2}}-h^{\frac{3}{2}}\right]^{\frac{2}{3}};$$

in which H and h have the same significance as in preceding formulas. and D is the effective head due to the measured head and velocity of approach. The weir discharge is then given by the proper formula for each type of weir as hereinbefore given. For any type of weir, if the Francis method of correcting for velocity of approach is used by comparing formula (2) to formula (1), or formula (4) to formula (3), it is seen that the increased discharge with velocity of approach bears to the discharge for the same weir and head without velocity of approach the ratio shown in the following formula:

$$(10)\quad \frac{Q'}{Q}=\frac{D^{\frac{3}{2}}}{H^{\frac{3}{2}}}=C;$$

in which Q', Q, H, and D have the same significance as in preceding formulas and C is a ratio varying with H and the velocity of approach. It is obvious that C applied as a coefficient to Q will give Q'.

14. *Submergence of weirs.*—Accurate measurement can not be made of submerged weir discharges, on account of lack of extensive accurate experiments for determining the discharge coefficient. Practically all of the older experiments on submerged weirs were on suppressed rectangular ones. Clemens Herschel, from a discussion of these experiments, derived a formula for computing discharges for such weirs. The Herschel formula is as follows:

$$(11)\quad Q_1=3.33\ L\ (n\ H)^{\frac{3}{2}};$$

in which L and H have their usual significance, as applied to a free suppressed rectangular weir, Q_1 is the discharge in second-feet with submergence, and n is a factor of correction taken from a table for varying values of the ratio of submergence, $(d \div H)$, d being the downstream head and H the upstream head on the weir, both in feet. Recently,[1] limited experiments have been made on submerged contracted weirs by J. C. Stevens, on the Sunnyside project of the service. These experiments were considered and combined by Stevens with the older ones and a diagram prepared for determining the discharges of submerged weirs, both contracted and suppressed, from appropriate tables of free weirs. These results differ only slightly from those of Herschel, so it may be roughly considered that Herschel's coefficients apply approximately to contracted as well as to suppressed weirs. In Herschel's formula the coefficient n is applied to the observed head above the weir crest on the upstream side. By comparing formula (11) to formula (3), the corresponding formula without submergence, it is seen that according to Herschel's formula the discharge of a submerged weir bears to that of a free weir with the same length and head the ratio shown in the following formula:

$$(12) \quad \frac{Q_1}{Q} = \frac{(nH)^{\frac{3}{2}}}{H^{\frac{3}{2}}} = C';$$

in which Q_1, Q, H and n have the same significance as in preceding formulas and C' is a ratio varying with n or with the ratio of submergence. It is obvious that C' applied as a coefficient to Q will give Q_1.

15. *Construction of weirs.*—Weir boxes should be substantially constructed of lumber or concrete. The weir box should in all cases extend downstream from the weir crest far enough to still the water before it passes back into the earth channel below. The floor of this downstream portion of the box may well be slightly depressed to form a stilling pool; the sides should be coincident with the overflow sheet for suppressed weirs, and should be set back slightly from the sides of the weir crest for contracted weirs. In suppressed weirs a pipe or other means should be provided for admitting air to the underside of the overfalling sheet in order to assure accurate contraction. The weir baseboard might well be made removable, so that the silt accumulating in the weir pool can be flushed out from time to time. In cases of suppressed weirs the weir box should be extended upstream several feet in order to insure perfect suppression of the end contractions. The crest of the weir in any case should be placed sufficiently high above the bed of the canal to insure perfect crest contraction. The sides of

[1] The text of the 1913 edition has been used unchanged.

contracted weirs should likewise be built sufficiently far from the sides of the channel to permit of perfect end contractions. Wing-walls or cut-off walls should be extended into the banks of the canal, both at the upper and lower end of the weir box, for the purpose of preventing leakage around the box, and for preventing back-cutting at the canal banks.

16. *Installation of weirs.*—The weir box should be installed sufficiently far from the turnout to permit of constructing a pool of the required length for stilling the water before passing through the weir. The leading channel or weir pool should be made with uniform dimensions, and of the required length to give proper approach and contraction of the water. The weir box should be carefully leveled in both directions at the time of installation. The weir crest should be accurately leveled and the sides of the weir set to the required slopes for the type of weir being installed. The structure should be carefully puddled to prevent the passing of water around or underneath it. There should be substantially installed a metallic gage reading to hundredths of a foot, located sufficiently far above the weir crest to be out of the effect of the draw-down at the weir crest. This gage should be accurately installed with its zero-point at the same elevation as that of the weir crest, and at a convenient location for checking these elevations from time to time. Where the elevation of the water-surface in the canal is low in comparison with adjacent land to be irrigated, and where there is but little fall in the land, extra precaution should be taken to prevent submergence of the weir.

17. *Care of weirs.*—The weir and weir pool should be freed from weeds and trash at each round of the canal rider and the weir pool should be cleaned of silt from time to time as it accumulates. The level of the crest should be checked from time to time, and should also be checked with reference to the elevation of the zero of the gage. Inspection should be made to determine whether there is leakage around the weir, and in the event of such leakage the structure should be immediately repuddled and carefully rechecked to see that the crest is level and at the elevation of the zero of the gage.

18. *Table 1.*—This table contains discharges in second-feet for standard contracted rectangular weirs without velocity of approach, computed from the Francis formula for the lengths and heads ordinarily used in measuring small quantities of irrigation water; except that for the 6-inch, 1-foot, 2-foot, and 3-foot weirs, for heads greater than one-third the crest length, the experimental values obtained on the Boise project have been used instead of the values given by the formula. This table may, therefore, be considered to give fairly accurate discharges for weirs of the above-stated lengths and for weirs of other lengths where the head does not exceed one-third the length of the weir crest. The method of using the table is apparent.

19. *Table 2.*—This table contains discharges in second-feet for standard Cippoletti weirs without velocity of approach, computed from the Cippoletti formula for the heads and lengths of weirs generally used in measuring small quantities of irrigation water; except that for the 6-inch, 1-foot, 2-foot, and 3-foot weirs, for heads greater than one-third the crest length, the discharges have been taken from experiments made on the Boise project. The data should, therefore, be considered fairly accurate for weirs of the above-stated lengths for all heads given in the table and for weirs of other lengths for heads not over one-third the crest length. This table is applicable also to standard suppressed rectangular weirs, as indicated in paragraph 12.

20. *Table 3.*—Table 3 gives coefficients, which, applied to the discharges taken from Table 1 or 2, will give the discharges for the same weirs when velocity of approach exists. When there is considerable velocity of approach, corrections should be made by means of this table. For this purpose the velocity of approach should first be computed as hereinbefore described. The discharge without velocity of approach should then be taken from Table 1 or 2 and Multiplied by the coefficient given in Table 3.

Illustration: Suppose it is desired to find the discharge of a standard suppressed rectangular weir with a crest length of 6 feet under a measured head of 2.5 feet and when there is a mean velocity of approach determined to be 1.5 feet per second. By Table 2 the discharge without velocity of approach is 79.85 second-feet. From Table 3, for a velocity of approach of 1.5 feet per second and with a head, H, of 2.5 feet, the coefficient is 1.019. $79.85 \times 1.019 = 81.367$ second-feet discharge with velocity of approach.

21. *Table 4.*—Table 4 gives coefficients, which, when applied to the discharge of a weir as taken from either Table 1 or 2, will give the discharge of the same weir when submerged. These coefficients will give approximate results at best and can not be relied upon for a high degree of accuracy in any case. To obtain the discharge of a submerged weir by means of these coefficients, first the discharge of the same weir, free, should be taken from Table 1 or 2 for the head on the upstream side of the weir and this discharge then multiplied by the proper coefficient obtained from Table 4.

Illustration: Suppose it is desired to find the discharge over a submerged standard Cippoletti weir with a crest length of 3 feet when the head on the upstream side is found to be 1.32 feet and the head on the downstream side of the weir 0.33 foot. By Table 2 the discharge of the same weir, free, under the same head, is 15.71 second-feet. The ratio $d \div H = 0.33 \div 1.32 = 0.25$, for which Table 4 gives a coefficient of 0.958. The product, $15.71 \times 0.958 = 15.5$ second-feet, the discharge of the weir, submerged.

22. *Table 5.*—Table 5 contains the acre-foot equivalents of given second-foot discharges for stated lengths of time. This table is designed to assist in reducing weir discharges to acre-foot quantities in working up the field records for office use. By means of this table the acre-foot equivalent of any second-foot discharge for any length of time may be obtained. For values not given directly in the table it is necessary only to multiply by the proper factors and add.

Illustration: Suppose it is desired to ascertain how many acre-feet are represented by a discharge of 14.52 second-feet flowing for 2 hours and 15 minutes. From the table (remembering that the tabular values are multiplied by 10 or by 100 by moving the decimal point one or two places to the right, respectively):

		Acre-feet
14	second-feet flowing 2 hours equals	2.314
14	second-feet flowing 15 minutes equals	.289
0.52	second-feet flowing 2 hours equals	.086
0.52	second-feet flowing 15 minutes equals	.011
14.52	second-feet flowing 2 hours and 15 minutes equals	2.700

PART II. SUBMERGED ORIFICES.

23. *Use of submerged orifices v. weirs.*—Where there is sufficient fall to permit of the measurement of water by means of a weir of reasonable length, the weir should by all means be chosen as the most desirable measuring device, as it will be free from detrimental effects from weeds and trash. Where, however, the amount of fall available for measuring the water is not adequate for the use of a weir of reasonable length, the submerged orifice should be used. In the measurement of water in laterals and farm ditches a weir can generally be used for all cases where there is as much as 0.5 of a foot of fall available, and even under the most adverse conditions the weir can be used for all falls exceeding one foot.

24. *Definition and classification of orifices.*—An orifice may be defined as an opening so placed in a wall of a channel or vessel carrying or holding water that the opening lies completely below the surface of the water on the upstream side thereof. The wall may have any angular position from horizontal to vertical, the opening may have any geometrical shape, the water may discharge into air or into water, and the issuing stream may or may not be contracted. The orifices generally employed for the measurement of irrigation water are either circular or rectangular and are vertical, that is, are placed in a vertical wall in a carrying channel. In the early days of irrigation such an orifice usually discharged into air, in which case the orifice was said to be free. Since the more general adoption of the weir for measuring irrigation water the free orifice

has been practically abandoned because it requires considerable fall for its use and, when this fall is available, the weir is more applicable. Later practice has developed the use of an orifice that discharges into water; such an orifice is said to be submerged. The submerged orifice is used where there is insufficient fall for the use of a weir. In addition to the subdivision of vertical orifices into free and submerged orifices, either of these classes may be contracted or suppressed. A contracted orifice is one with its perimeter so far removed from the bounding surfaces of the water prism in the channel of approach or other surfaces of a disturbing nature that the filaments of water are fully contracted as they pass through the orifice. A suppressed orifice is one with its perimeter coincident with the sides of the channel of approach or with other surfaces eliminating contraction. Evidently an orifice may be contracted or suppressed on any part or all of its perimeter or it may be imperfectly contracted and suppressed on any part or all of its perimeter. This latter condition is the result of the existence of a disturbing surface intervening between that producing contraction and that producing suppression. If the opening is not sharp-edged or if the wall in which it is cut or formed has material thickness or if a discharge tube is attached, then the opening becomes a submerged tube. This condition may exist all around the opening or only partially so, or it may be caused by placing too close to the opening the bounding surfaces of the water prism in the channel of approach. For these different conditions different coefficients of discharge apply.

25. *Type of orifice adopted.*—The principal type of orifice adopted by the service for the measurement of irrigation water is the vertical, sharp-edged, contracted, rectangular, submerged, orifice. This type will be hereafter designated as the standard submerged rectangular orifice. The reasons for selecting this type for general use are that it is well suited for securing accuracy and is the principal type for which the discharge coefficient has been carefully determined.

26. *Definition and conditions for accuracy of standard submerged rectangular orifices.*—The standard submerged rectangular orifice is a submerged rectangular orifice with its four sides consisting of thin-edged plates, each so far removed from the adjacent side, bottom, or top of the water prism in the leading channel as to cause the filaments of water to be fully deflected from their normal course as they pass through the orifice. The deflection is approximately the maximum deflection that would obtain with the sides of the orifice at unlimited distances from the water prism boundaries. The sides of the orifice may be made of planks if the upstream edges are definite, rectangular corners, but it is best to use a thin metal plate. The conditions that are considered necessary to secure perfect contraction and accuracy of measurement are as follows:

(*a*) The upstream edges of the orifice should be sharp and smooth and the distance of each from the bounding surfaces of the channel, both on the upstream and on the downstream side, should preferably be not less than twice the least dimension of the orifice.

(*b*) The upstream face of the orifice wall should be vertical.

(*c*) The top and bottom edges should be level from end to end.

(*d*) The sides should be truly vertical.

(*e*) The head on the orifice that should be measured is the actual difference in elevation between the water surface on the upstream side of the orifice and the water surface on the downstream side thereof.

(*f*) The cross-sectional area of the water prism for 20 to 30 feet from the orifice on the upstream and on the downstream side thereof should be at least six times the cross-sectional area of the orifice.

(*g*) Correction should be made for velocity of approach where appreciable errors are caused by neglecting the head due to it.

27. *Suitable dimensions for standard submerged rectangular orifices.*—The most suitable dimensions for standard submerged rectangular orifices are those in which the height is considerably less than the length. This is due to the fact that the ratio of depth to width of irrigation canals and laterals is small. Convenient dimensions for submerged orifices are ¼ foot by 1 foot, 2 feet, or 3 feet; ½ foot by 1 foot, 1½ feet, 2 feet, 2½ feet, or 3 feet; ¾ foot by 1⅓ feet, 1⅔ feet, 2 feet, 2⅓ feet, or 2⅔ feet. These dimensions will give orifices varying in area from 0.25 to 2.0 square feet in intervals of 0.25 square foot. Where possible an orifice of 1 square foot area should be chosen, as the unit area simplifies the discharge determination somewhat and will give discharges ranging from 0.0 to nearly 3.5 second-feet under heads varying from 0.0 to 0.5 foot. However, the size of the orifice selected will necessarily be determined by the quantity of water to be measured and the available fall that can be utilized therefor.

28. *Formulas for standard submerged rectangular orifice.*—The formula for computing the discharge of the standard submerged rectangular orifice, without velocity of approach, is as follows:

$$(13) \quad Q = 0.61\sqrt{2gH}\ A;$$

and with velocity of approach is as follows:

$$(14) \quad Q' = 0.61\ \sqrt{2g\ (H+h)}\ A;$$

in which Q is the discharge in second-feet without velocity of approach; Q' the discharge in second-feet with velocity of approach; g gravity in feet; H the measured head on the orifice in feet, being equal to the difference in elevation of the water surface on the upstream side of the orifice and the water surface on the downstream side thereof; h the head due to velocity of approach in feet, and A the area of the orifice in square feet.

29. *Velocity of approach in submerged orifice measurements.*—So far as practicable submerged orifices should be so installed as to make the velocity of approach negligible, but where this is impracticable appropriate corrections therefor should be made. Attention is called to the fact that neglecting moderate velocities of approach with low heads on the orifice produces relatively large errors, whereas neglecting comparatively high velocities of approach with large heads on the orifice produces relatively small errors. The velocity of approach may be computed from formula (7), page 8, and after the velocity of approach is determined, the head due to the velocity of approach may be computed from formula (8), page 8. This velocity head, designated as h, should be added to the measured head, as indicated by formula (14), before computing the discharge by the formula or before taking it from the discharge table.

30. *Correction for suppression of contraction in submerged orifices.*—While it is deemed desirable to use the standard submerged rectangular orifice so far as conditions will permit, it may be necessary in some cases, for the purpose of avoiding accumulations of silt on the upstream side of the orifice, to suppress bottom contraction by placing the lower side of the orifice at canal grade, and cases may now and then arise where it will be necessary to determine the discharge of submerged orifices that have also their side contractions suppressed. The discharge coefficients where suppression exists are not well determined, and it is therefore undesirable to permit suppression except where unavoidable. In such cases the discharge for the submerged rectangular orifice without velocity of approach may be computed approximately by the following formula:

$$(15) \quad Q_1 = 0.61\ (1+0.15\ r)\ \sqrt{2gH}\ A;$$

and with velocity of approach by the following formula:

$$(16) \quad Q'_1 = 0.61\ (1+0.15\ r)\ \sqrt{2g\ (H+h)}\ A;$$

in which Q_1 is the discharge in second-feet of the suppressed orifice without velocity of approach; Q'_1 the discharge in second-feet of the suppressed orifice with velocity of approach; r the ratio of the suppressed portion of the perimeter of the orifice to the whole perimeter, and H, A, and h have the same significance as in formulas (13) and (14). By comparison of formula (15) to formula (13) and formula (16) to formula (14) the following relations are derived:

$$(17) \quad \frac{Q_1}{Q} = \frac{Q'_1}{Q'} = 1+0.15\ r = C;$$

in which Q, Q', Q_1, Q'_1, and r have the same significance as in formulas (13) to (16) and C is a constant equal to $1+0.15\ r$. It is obvious that C applied as a coefficient to Q or Q' will give Q_1 or Q'_1, respectively.

31. *Construction of submerged orifices.*—Submerged orifice boxes should be substantially constructed of lumber or concrete. The orifice box should be of sufficient length to extend downstream from the orifice wall far enough to still the water before it passes back into the earth channel below. The floor should be depressed below the canal grade to form a stilling pool and the floor and sides should be set at distances from the orifice opening of not less than twice the least dimension of the orifice. A flashboard may be placed at the lower end of the orifice box to secure submergence of the orifice, but the box must have sufficient length in such a case to prevent disturbance in the water issuing from the orifice. The orifice wall should be set truly vertical and should reach only to the maximum water level so as to form an overflow in case of trouble. Wing-walls or cut-off walls should be provided, both at the upper end and the lower end of the orifice box, for the purpose of preventing erosion of the canal banks and leakage on water around the structure.

32. *Installation of submerged orifices.*—The orifice box should be installed sufficiently far from the turnout to permit the construction of a pool of the required length for stilling the water before it passes through the orifice. The pool should be made with uniform dimensions and with its bottom about one foot below the normal grade of the canal to insure bottom contraction. The structure should be carefully levelled when installed and thoroughly puddled to prevent leakage. A gage should be placed on the upstream side of the orifice and another on the downstream side thereof having the same zero elevation. The upstream gage should be located at a convenient place on the upstream side of the orifice wall and the downstream gage should be placed on the side-wall of the orifice box sufficiently far downstream from the orifice wall to register the true back pressure on the orifice. This distance will be at least two feet for small orifices. Great care should be taken to fix the gages truly vertical and to set their zero marks at the same elevation.

33. *Care of submerged orifices.*—The submerged orifice and pool should be freed from weeds and trash at each round of the canal rider and the pool should be cleared of silt often enough to maintain proper stilling of the water and bottom contraction of the orifice. The orifice should be carefully checked from time to time to insure that the dimensions and elevation are unchanged, the sides truly vertical, the upper and lower crests level and the zero marks of the gages at the same elevation. Inspection should be made from time to time to determine whether there is any leakage around the structure and, in event of such leakage, the structure should be immediately repuddled and the orifice should again be checked as above indicated.

34. *Table 6.*—Table 6 contains discharges in second-feet of standard submerged rectangular orifices without velocity of approach for commonly used heads and orifice areas, computed from formula (13), page 14. The method of using the table is apparent. The head, H, is the observed head plus the head due to any velocity of approach that may exist.

35. *Table 7.*—Table 7 gives coefficients, which applied to a discharge given by Table 6 will give the discharge of the same orifice suppressed on the bottom alone or on the bottom and two sides. For an orifice constructed as a suppressed orifice or one in which silt has collected sufficiently to effect suppression, the discharge should be corrected by means of this table. First the discharge without suppression should be taken from Table 6 and then multiplied by the proper coefficient taken from Table 7.

Illustration: Suppose it is desired to find the discharge of a standard submerged rectangular orifice 0.5 by 2.5 feet with bottom and side suppressions under a head of 0.18 foot. For an area of 1.25 square feet ($=0.5\times2.5$) and a head of 0.18 foot, Table 6 gives a discharge of 2.593 second-feet. For a height, d, of 0.5 foot and a length, l, of 2.5 feet, with bottom and sides suppressed, Table 7 gives a coefficient of 1.09. Then $2.593\times1.09=2.826$ second-feet, the discharge desired.

PART III. CURRENT METER GAGING STATIONS.

36. *Use of current meter stations v. weirs and submerged orifices.*—Where the quantity of water to be measured is large and the available fall small, or where the quantity of water is small and extremely heavily laden with silt, the use of current meter stations is advisable. Their use should be reduced to the minimum, however, as their operation is comparatively expensive and the results are relatively unsatisfactory. Only a very brief discussion of current meter stations will be given here and the reader is referred to the Water-Supply Papers of the United States Geological Survey and technical books on the subject for further information.

37. *Selection of current meter stations.*—A current meter station should be located in a straight uniform stretch of canal with smooth banks and bed of permanent nature, so far removed from turnouts, drops, and checks that the relation of discharge to gage height will not be disturbed by these. In many canals these conditions are difficult to find in combination and unusual care has to be taken to obtain a station that will give good results.

38. *Current meter station equipment.*—The essential features of a current meter station are a gage, a bench mark, fixed measuring points in the channel cross section, and a stayline to hold the meter in the measuring plane or cross section when the velocity is high

and the water deep. The gage should be of a good design, substantially installed where it will indicate the water elevation at all stages, and should be so graduated as to permit accurate readings to hundredths of a foot. (See fig. 2.) The bench mark should be conveniently and permanently located and the elevation of the datum of the gage should be carefully referred to it. The measuring points should be located in a cross section at right angles to the stream flow on a tagged wire stretched across the channel or on a bridge located at the station. Where the canal is shallow enough to permit of wading measurements, the tagged wire will be applicable; otherwise a highway bridge or a small bridge constructed for the purpose should be used. The measuring points should be permanently fixed and marked at equal intervals of from two to ten feet depending upon the size of the canal. The stayline should be stretched across the canal far enough above the measuring section to hold the current meter in proper position. (See fig. 1.)

39. *Current meters.*—The essential features of all current meters are a wheel capable of rotation by impact of water and a device for determining the number of revolutions of the wheel. The relation of the velocity of the water to the angular velocity of the wheel or the number of revolutions of the wheel in a given time is determined by experiment, and should be checked and redetermined from time to time. A sample rating table for a small Price meter is given in Table 8. The two types of meters most widely used are the Haskell and the Price. The wheel of the former consists of a screw-shaped head mounted on a horizontal axis, while that of the latter consists of a group of conical cups set with the axes of the cones tangent to a circle, the whole group being mounted on a vertical axis. Both types are provided with vanes to keep the wheel headed against the current, weights for sinking the meter, a cable for handling the meter, and electric or acoustic sounder for indicating the number of revolutions and connections from the meters to the sounding devices. The Price meter has been developed by the United States Geological Survey for use in its work and a cut of it as now manufactured is shown in figure 4.

40. *Methods of measurement.*—Soundings, either with a meter or with a special sounding line and weight, should be made at the permanent measuring points. The mean velocity at each of these measuring points should then be determined by means of the current meter, in accordance with one of the approved methods of determining mean velocities.

41. *Methods of determining mean velocities.*—There are five general methods of determining mean velocities in a vertical line with a current meter: (*a*) By taking the velocity at 0.2 and that at 0.8 of the water depth and obtaining one-half the sum; (*b*) by taking the velocity at 0.6 of the water depth; (*c*) by taking the velocities at

equal vertical intervals of 0.5 of a foot or more and obtaining their arithmetical mean, or finding the mean value from a curve derived by plotting the measurements on cross section paper; (*d*) by taking the velocity near the water surface and using from 0.85 to 0.95 of the result, depending on the depth of water, its velocity, and the nature of the canal bed, and (*e*) by taking velocity in the vertical line by slowly and uniformly lowering and raising the meter throughout the range of water depth one or more times. Of the methods given, the first two are most used in canal work.

42. *Methods of computing discharge measurements.*—There are two important methods of computing discharges from measurements made by current meters. Both of these methods are based on determining the discharges of the elementary areas between the measuring points and taking their sum. In one of the methods the discharge is computed separately for each elementary area on the assumption that both the velocity and the water depth vary uniformly from one measuring point to another. This may well be termed the "straight-line" method, and the formula for computing the discharge of the elementary area is as follows:

$$(18)\quad q=\left(\frac{Va+Vb}{2}\right)\left(\frac{a+b}{2}\right)l;$$

in which a and b are the water depths in feet at two adjacent measuring points, Va and Vb the respective mean velocities in feet per second at these points, l the distance in feet between the points, and q the discharge in second-feet for the elementary area. Formula (18) is well suited to computing discharges in canals conforming in cross section to their original trapezoidal or rectangular dimensions. In the other method the discharge is computed for consecutive pairs of elementary areas on the assumption that the velocities and the water depths for three consecutive measuring points each lie on the arc of a parabola. This method might well be termed the parabolic method and the formula for computing the discharge for each pair of elementary areas is as follows:

$$(19)\quad q'=\left(\frac{Va+4Vb+Vc}{6}\right)\left(\frac{a+4b+c}{6}\right)2l;$$

in which a, b, and c are the water depths in feet at three consecutive measuring points, Va, Vb, and Vc the respective mean velocities in feet per second at these points, l the distance in feet between the consecutive points, and q' the discharge in second-feet for the pair of elementary areas. Formula (19) is more particularly applicable to river channels and old canals that have cross sections conforming in a general way to the arc of a parabola or to a series of arcs of different parabolas. (See Table 9.)

43. *Range of discharge measurements.*—The discharge measurements of a canal at a current meter station should be taken at sufficient intervals of gage heights to permit of making accurate velocity, area, and discharge curves. Inasmuch as water is usually turned into the canals gradually in the beginning of each irrigation season, it is possible at this time to get well-distributed measurements for the condition of the canal at this season. The canal bed at a well-selected current meter station is generally permanent in character, and a permanent rating curve for the canal could be made were it not for the fact that increased vegetable growth in the canal and on its banks during the irrigation season, together with accumulations of silt, decrease the discharge capacity for all gage heights during the latter part of the irrigation season. This fact must be taken into consideration in computing the quantity of water carried by a canal during the irrigation season. If the canal is cleaned during the season, the relation of discharge to gage height is again disturbed. These changing relations of discharge to gage height are the chief source of errors and difficulties in irrigation canal hydrography.

44. *Daily gage heights.*—In order to determine the quantity of water carried by a canal at a current meter station it is necessary to read the gage twice daily and additionally at such times as changes of stage are made in the canal. These readings should be taken by the canal riders while on their daily rounds. The gages should be read accurately, generally to the nearest hundredth of a foot. The gage should be read carefully also by the hydrographer both before and after taking a current meter measurement.

45. *Computation of discharges.*—The current meter measurements at a station are interpreted and extended to cover all gage heights at the station by means of curves drawn on cross-section paper. To construct these curves the discharges of the canal in second-feet as computed from individual current meter discharge measurements, the corresponding mean velocities in feet per second and the cross sectional areas in square feet for each measurement are plotted as abscissas, each to a convenient scale, with the common gage heights as ordinates. The most probable area curve is drawn through the area plottings and from this the accuracy of the area computations and of the soundings are checked and, in case of a shifting channel, changes in the rating section are discovered. The most probable velocity curve is drawn through the velocity plottings on the sheet to provide a graphic means of finding inaccuracies in the computations and noting disturbances in the velocity due to obstructions in the channel or changes in the velocity due to increased roughness of the channel from vegetable growths in the canal. The discharge curve is then drawn through the discharge points on the cross-section

paper, giving due weight to the various measurements and to products of the mean velocity and area abscissas for various gage heights throughout the range of canal depths. Where the conditions of flow of the canal have not been changed during the irrigation season, it will generally be comparatively easy to draw a satisfactory curve. Where, however, the relation of discharge to gage height has been affected by vegetable growth, or the introduction of other obstructions, these conditions must be given careful consideration and another curve drawn for that part of the irrigation season during which such conditions have existed. The discharge curve for these conditions will generally be parallel to the discharge curve for the earlier part of the irrigation season when the canal is clean. For the period during which the change is in progress the discharges must be estimated on the theory of proportion from the two curves constructed for the extreme conditions. (See fig. 3.)

46. *Rating table.*—From the rating curve the rating table may be prepared for each tenth or hundredth of a foot of gage height as the condition of accuracy may require, ranging from zero to the maximum height of water in the canal. In case of canals affected by vegetable growth two such rating tables will have to made, one applying to the early part of the irrigation season when the canal is clean and the other to the latter part of the irrigation season when the canal is in bad condition. Daily discharges will also have to be estimated for the period in which the change in the canal is being effected. In case the canal is cleaned at any time during the irrigation season, this fact must be given consideration in preparing the necessary additional rating curves. (See Table 10.)

47. *Compilation of daily and monthly discharges.*—By means of daily gage heights and the rating tables the daily discharges may readily be compiled, and adding these gives the monthly discharges and the total amount of water carried by the canal during the irrigation season.

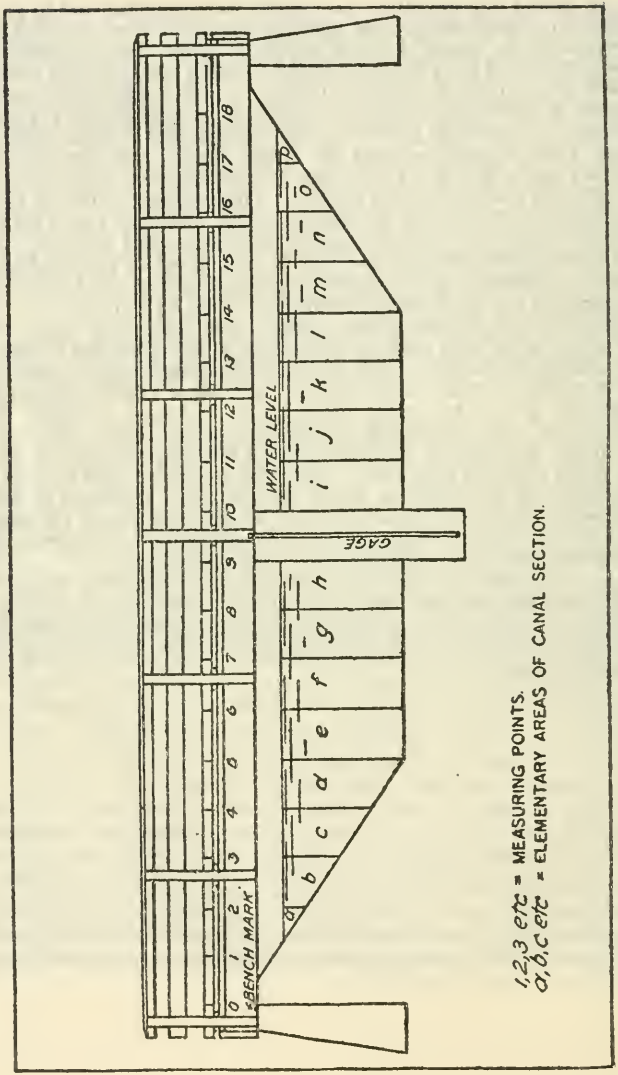

FIG. 1.—Typical canal current meter station.

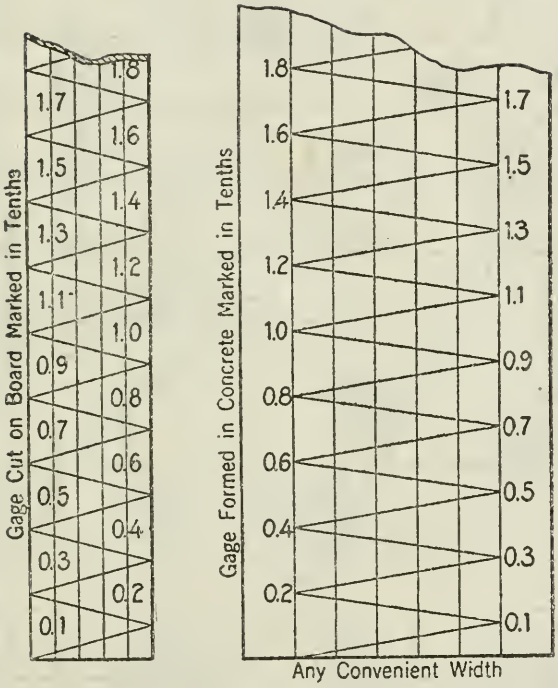

FIG. 2.—Steward water gages.

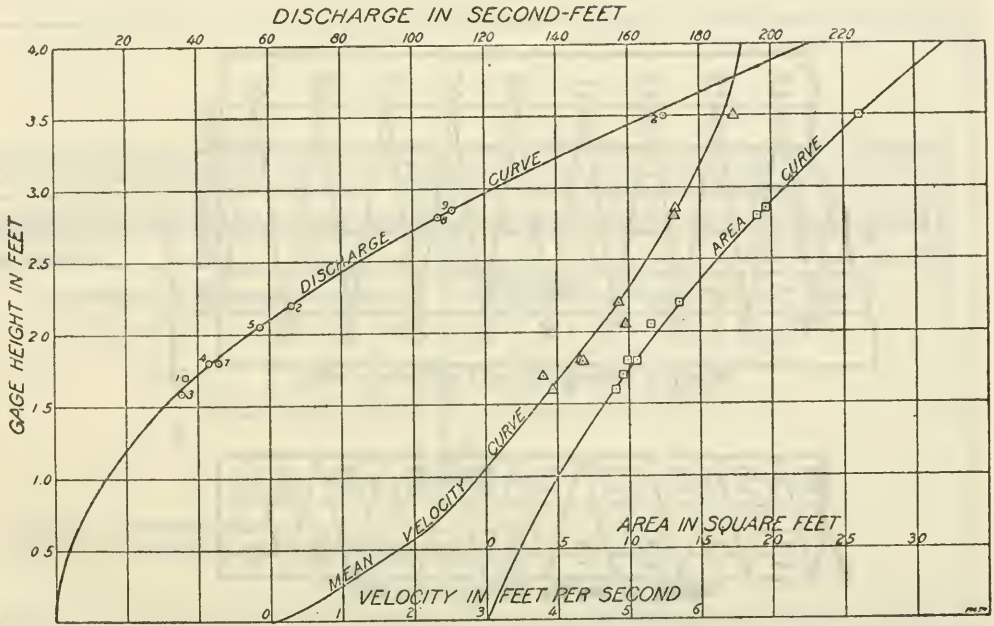

FIG. 3.—Discharge, mean velocity, and area curves for power canal, Strawberry Valley project, Utah.

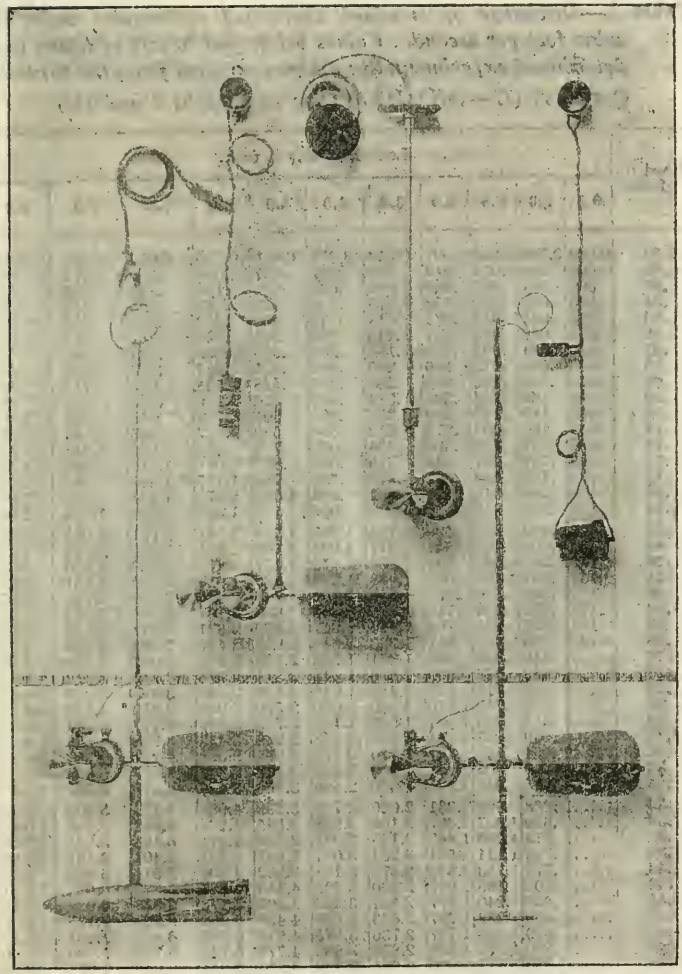

FIG. 4.—Small price meters.

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Table 1.—*Discharge of standard contracted rectangular weirs in cubic feet per second. Values below and to left of heavy line determined experimentally; others computed from the formula* $Q = 3.33\ (L - .2H)\ H^{\frac{3}{2}}$. *(See paragraphs 8 and 18.)*

Head *H*, feet	Length of weir *L*, feet.										
	0.5	**1.0**	**1.5**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**
0.01	0.002	0.003	0.005	0.007	0.010	0.013	0.016	0.020	0.023	0.026	0.030
.02	.005	.009	.014	.019	.028	.037	.047	.056	.066	.075	.085
.03	.009	.017	.026	.034	.052	.069	.086	.104	.121	.138	.155
.04	.013	.026	.040	.053	.079	.106	.133	.159	.186	.213	.239
.05	.018	.037	.055	.074	.111	.148	.186	.223	.260	.297	.334
.06	.024	.048	.073	.097	.146	.195	.244	.293	.342	.391	.439
.07	.030	.061	.092	.123	.184	.246	.308	.369	.431	.493	.554
.08	.036	.074	.112	.149	.225	.300	.375	.451	.526	.601	.676
.09	.043	.088	.133	.178	.268	.358	.448	.538	.628	.718	.807
.10	.051	.103	.156	.208	.314	.419	.524	.630	.735	.840	.945
.11	.058	.119	.179	.240	.362	.483	.605	.726	.848	.969	1.091
.12	.066	.135	.204	.273	.412	.550	.689	.827	.965	1.104	1.242
.13	.074	.152	.230	.308	.464	.620	.776	.933	1.089	1.245	1.401
.14	.082	.169	.257	.344	.518	.693	.867	1.041	1.216	1.390	1.565
.15	.091	.188	.284	.381	.575	.768	.962	1.155	1.349	1.542	1.736
.16	.100	.206	.313	.419	.632	.845	1.059	1.272	1.485	1.698	1.911
.17	.109	.225	.342	.459	.692	.926	1.159	1.392	1.626	1.859	2.093
.18	.122	.245	.372	.499	.754	1.008	1.262	1.517	1.771	2.025	2.279
.19	.132	.265	.403	.541	.817	1.093	1.369	1.644	1.920	2.196	2.472
.20	.142	.286	.435	.584	.881	1.179	1.477	1.775	2.073	2.370	2.668
.21	.152	.307	.467	.627	.948	1.269	1.589	1.910	2.230	2.551	2.871
.22	.162	.328	.500	.672	1.016	1.359	1.703	2.046	2.390	2.734	3.077
.23	.173	.350	.534	.718	1.085	1.452	1.820	2.187	2.554	2.921	3.289
.24	.184	.373	.568	.764	1.156	1.547	1.939	2.331	2.722	3.113	3.505
.25	0.195	.395	.603	.811	1.228	1.644	2.060	2.476	2.893	3.309	3.725
.26	.....	.419	.639	.860	1.301	1.743	2.185	2.626	3.067	3.509	3.951
.27	.....	.442	.675	.909	1.376	1.843	2.311	2.778	3.245	3.712	4.179
.28	.....	.466	.712	.959	1.453	1.946	2.439	2.933	3.426	3.919	4.413
.29	.....	.490	.750	1.010	1.530	2.050	2.570	3.090	3.610	4.130	4.650
.30	.....	.514	.788	1.061	1.609	2.156	2.703	3.251	3.797	4.344	4.892
.31	.....	.539	.827	1.114	1.689	2.263	2.838	3.413	3.988	4.563	5.137
.32	.....	.564	.866	1.167	1.770	2.373	2.975	3.578	4.181	4.784	5.387
.33	.....	.590	.905	1.221	1.852	2.483	3.115	3.746	4.377	5.009	5.640
.34	.....	.615	.945	1.275	1.936	2.596	3.256	3.916	4.577	5.237	5.897
.35	.....	.658	.986	1.331	2.020	2.710	3.399	4.089	4.778	5.468	6.157
.36	.....	.686	1.027	1.387	2.106	2.825	3.545	4.264	4.983	5.703	6.422
.37	.....	.714	1.069	1.443	2.193	2.943	3.692	4.441	5.191	5.941	6.690
.38	.....	.743	1.111	1.501	2.281	3.061	3.841	4.621	5.401	6.181	6.961
.39	.....	.772	1.153	1.559	2.370	3.181	3.992	4.803	5.614	6.425	7.236
.40	.....	.801	1.196	1.617	2.460	3.302	4.145	4.987	5.829	6.672	7.514
.41	.....	.830	1.240	1.677	2.551	3.425	4.299	5.173	6.048	6.922	7.796
.42	.....	.860	1.283	1.737	2.643	3.549	4.456	5.362	6.269	7.175	8.081
.43	.....	.890	1.328	1.797	2.736	3.675	4.614	5.553	6.492	7.431	8.370
.44	.....	.920	1.372	1.858	2.830	3.802	4.774	5.746	6.718	7.690	8.661
.45	.....	.950	1.417	1.920	2.925	3.930	4.935	5.941	6.946	7.951	8.956
.46	.....	.981	1.463	1.982	3.021	4.060	5.099	6.138	7.177	8.216	9.255
.47	.....	1.012	1.509	2.045	3.118	4.191	5.264	6.337	7.410	8.483	9.556
.48	.....	1.044	1.555	2.108	3.216	4.323	5.431	6.538	7.645	8.753	9.860
.49	.....	1.077	1.601	2.172	3.315	4.457	5.599	6.741	7.883	9.026	10.168
0.50	.....	1.111	1.648	2.237	3.414	4.591	5.769	6.946	8.123	9.301	10.478

Table 1.—*Discharge of standard contracted rectangular weirs in cubic feet per second. Values below and to left of heavy line determined experimentally; others computed from the formula* $Q = 3.33\ (L - .2H)\ H^{\frac{3}{2}}$. *(See paragraphs 8 and 18.)*

Head H, feet	Length of weir L, feet.								
	1.5	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
0.51	1.695	2.302	3.515	4.727	5.940	7.153	8.366	9.579	10.791
.52	1.743	2.367	3.616	4.865	6.114	7.362	8.611	9.860	11.108
.53	1.791	2.434	3.719	5.003	6.288	7.573	8.858	10.143	11.428
.54	1.839	2.500	3.821	5.143	6.464	7.786	9.107	10.428	11.750
.55	1.888	2.567	3.925	5.284	6.642	8.000	9.359	10.717	12.075
.56	1.937	2.635	4.030	5.426	6.821	8.217	9.612	11.008	12.403
.57	1.986	2.703	4.136	5.569	7.002	8.435	9.868	11.301	12.734
.58	2.036	2.771	4.242	5.713	7.184	8.655	10.126	11.597	13.067
.59	2.085	2.840	4.349	5.858	7.367	8.877	10.386	11.895	13.404
.60	2.136	2.909	4.457	6.005	7.552	9.100	10.647	12.195	13.743
.61	2.186	2.979	4.566	6.152	7.739	9.325	10.912	12.498	14.085
.62	2.237	3.050	4.675	6.301	7.927	9.553	11.178	12.804	14.430
.63	2.288	3.121	4.786	6.451	8.116	9.781	11.447	13.112	14.777
.64	2.339	3.192	4.897	6.602	8.307	10.012	11.717	13.422	15.127
.65	2.391	3.263	5.008	6.753	8.499	10.244	11.989	13.734	15.479
.66	2.443	3.335	5.121	6.906	8.692	10.477	12.263	14.048	15.834
.67	2.495	3.408	5.234	7.060	8.886	10.712	12.539	14.365	16.191
.68	2.547	3.58	5.348	7.215	9.083	10.950	12.817	14.684	16.552
.69	2.599	3.66	5.462	7.371	9.280	11.188	13.097	15.005	16.914
.70	2.652	3.74	5.578	7.528	9.478	11.429	13.379	15.329	17.280
.71	2.705	3.82	5.694	7.686	9.678	11.670	13.663	15.655	17.647
.72	2.759	3.90	5.810	7.845	9.879	11.913	13.948	15.982	18.017
.73	2.813	3.98	5.928	8.005	10.082	12.159	14.236	16.313	18.390
.74	2.866	4.06	6.046	8.165	10.285	12.405	14.525	16.645	18.764
.75	2.920	4.14	6.164	8.327	10.490	12.653	14.816	16.979	19.142
.76	.....	4.22	6.283	8.490	10.696	12.902	15.109	17.315	19.521
.77	.....	4.30	6.403	8.653	10.903	13.153	15.403	17.653	19.903
.78	.....	4.38	6.524	8.818	11.112	13.406	15.700	17.994	20.288
.79	.....	4.46	6.645	8.983	11.321	13.660	15.998	18.336	20.674
.80	.....	4.54	6.767	9.150	11.533	13.915	16.298	18.681	21.064
.81	.....	4.62	6.889	9.317	11.745	14.172	16.600	19.027	21.455
.82	.....	4.70	7.013	9.485	11.958	14.431	16.903	19.376	21.849
.83	.....	4.78	7.136	9.654	12.172	14.690	17.208	19.726	22.244
.84	.....	4.87	7.260	9.824	12.388	14.951	17.515	20.079	22.643
.85	.....	4.96	7.385	9.995	12.604	15.214	17.823	20.433	23.043
.86	.....	5.05	7.511	10.166	12.822	15.478	18.134	20.790	23.445
.87	.....	5.14	7.635	10.339	13.041	15.743	18.445	21.147	23.850
.88	.....	5.23	7.763	10.512	13.261	16.010	18.759	21.508	24.257
.89	.....	5.32	7.890	10.686	13.482	16.278	19.074	21.869	24.665
.90	.....	5.41	8.018	10.861	13.704	16.547	19.391	22.234	25.077
.91	.....	5.50	8.146	11.037	13.927	16.818	19.709	22.599	25.490
.92	.....	5.59	8.275	11.213	14.152	17.090	20.029	22.967	25.906
.93	.....	5.68	8.404	11.391	14.377	17.363	20.350	23.337	26.323
.94	.....	5.77	8.534	11.569	14.603	17.638	20.673	23.708	26.743
.95	.....	5.86	8.664	11.748	14.831	17.915	20.998	24.081	27.165
.96	.....	5.95	8.795	11.927	15.060	18.192	21.324	24.456	27.588
.97	.....	6.04	8.927	12.108	15.289	18.471	21.652	24.833	28.015
.98	.....	6.13	9.059	12.289	15.520	18.750	21.981	25.212	28.442
.99	.....	6.22	9.191	12.471	15.751	19.032	22.312	25.592	28.872
1.00	.....	6.31	9.324	12.654	15.984	19.314	22.644	25.974	29.304

Table 1.—*Discharge of standard contracted rectangular weirs in cubic feet per second. Values to left of heavy line determined experimentally; others computed from the formula* $Q = 3.33\ (L - .2H)\ H^{\frac{3}{2}}$. *(See paragraphs 8 and 18.)*

Head H, feet	Length of weir L, feet.						
	3.0	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**
1.01	9.87	12.838	16.218	19.598	22.978	26.358	29.738
1.02	10.01	13.022	16.452	19.883	23.313	26.743	30.174
1.03	10.15	13.207	16.688	20.169	23.650	27.131	30.612
1.04	10.30	13.394	16.924	20.456	23.988	27.520	31.051
1.05	10.45	13.579	17.162	20.744	24.327	27.910	31.493
1.06	10.60	13.763	17.401	21.035	24.669	28.303	31.937
1.07	10.75	13.954	17.640	21.325	25.011	28.697	32.383
1.08	10.90	14.143	17.880	21.618	25.355	29.093	32.830
1.09	11.05	14.332	18.121	21.911	25.700	29.490	33.279
1.10	11.20	14.522	18.364	22.206	26.047	29.889	33.731
1.11	11.35	14.713	18.607	22.501	26.395	30.290	34.184
1.12	11.50	14.904	18.851	22.798	26.745	30.692	34.639
1.13	11.65	15.096	19.096	23.096	27.096	31.096	35.096
1.14	11.80	15.289	19.342	23.390	27.448	31.501	35.555
1.15	11.95	15.482	19.589	23.696	27.802	31.909	36.016
1.16	12.10	15.676	19.837	23.997	28.157	32.318	36.478
1.17	12.25	15.871	20.085	24.300	28.513	32.728	36.943
1.18	12.40	16.066	20.335	24.603	28.871	33.140	37.408
1.19	12.55	16.262	20.585	24.908	29.231	33.553	37.876
1.20	12.70	16.459	20.836	25.214	29.591	33.969	38.346
1.21	12.85	16.656	21.088	25.521	29.953	34.385	38.817
1.22	13.00	16.854	21.341	25.829	30.316	34.803	39.291
1.23	13.15	17.053	21.595	26.138	30.681	35.223	39.766
1.24	13.31	17.252	21.850	26.448	31.046	35.644	40.243
1.25	13.47	17.452	22.105	26.759	31.413	36.067	40.721
1.26	13.63	17.652	22.362	27.072	31.782	36.491	41.201
1.27	13.79	17.853	22.619	27.385	32.151	36.917	41.683
1.28	13.95	18.055	22.877	27.700	32.522	37.345	42.167
1.29	14.11	18.257	23.136	28.015	32.894	37.773	42.652
1.30	14.27	18.460	23.396	28.331	33.267	38.203	43.139
1.31	14.43	18.663	23.656	28.649	33.642	38.635	43.628
1.32	14.59	18.867	23.918	28.968	34.018	39.068	44.119
1.33	14.75	19.072	24.180	29.287	34.395	39.503	44.611
1.34	14.91	19.277	24.443	29.608	34.773	39.939	45.104
1.35	15.07	19.483	24.706	29.929	35.153	40.376	45.599
1.36	15.23	19.689	24.970	30.252	35.533	40.815	46.096
1.37	15.39	19.896	25.236	30.576	35.915	41.255	46.595
1.38	15.55	20.104	25.502	30.900	36.299	41.697	47.096
1.39	15.71	20.312	25.769	31.226	36.683	42.140	47.598
1.40	15.87	20.520	26.036	31.553	37.069	42.585	48.101
1.41	16.03	20.729	26.305	31.880	37.455	43.031	48.606
1.42	16.19	20.939	26.574	32.209	37.843	43.478	49.113
1.43	16.35	21.149	26.843	32.538	38.232	43.927	49.621
1.44	16.51	21.359	27.114	32.868	38.622	44.376	50.131
1.45	16.68	21.571	27.385	33.200	39.014	44.828	50.643
1.46	16.85	21.783	27.657	33.532	39.406	45.281	51.155
1.47	17.02	21.995	27.930	33.865	39.800	45.735	51.670
1.48	17.19	22.208	28.204	34.199	40.195	46.191	52.187
1.49	17.36	22.421	28.478	34.534	40.591	46.647	52.704
1.50	17.53	22.635	28.753	34.870	40.988	47.105	53.223

Table 1.—*Discharge of standard contracted rectangular weirs in cubic feet per second, computed from the formula* $Q = 3.33 (L - .2H) H^{\frac{3}{2}}$. (*See paragraphs* 8 *and* 18.)

Head H, feet	Length of weir L, feet.					
	4.0	5.0	6.0	7.0	8.0	9.0
1.51	22.849	29.028	35.207	41.386	47.565	53.744
1.52	23.065	29.305	35.545	41.786	48.026	54.267
1.53	23.279	29.581	35.883	42.185	48.487	54.789
1.54	23.495	29.859	36.223	42.587	48.951	55.315
1.55	23.712	30.138	36.564	42.990	49.416	55.842
1.56	23.929	30.417	36.905	43.394	49.882	56.370
1.57	24.146	30.697	37.248	43.799	50.349	56.900
1.58	24.364	30.978	37.591	44.205	50.818	57.432
1.59	24.583	31.259	37.935	44.612	51.288	57.965
1.60	24.801	31.540	38.280	45.019	51.759	58.498
1.61	25.020	31.823	38.626	45.428	52.231	59.034
1.62	25.240	32.106	38.973	45.839	52.705	59.571
1.63	25.460	32.390	39.320	46.250	53.180	60.110
1.64	25.681	32.675	39.668	46.662	53.656	60.649
1.65	25.902	32.960	40.018	47.075	54.133	61.191
1.66	26.124	33.246	40.368	47.490	54.612	61.734
1.67	26.346	33.532	40.719	47.905	55.092	62.278
1.68	26.568	33.819	41.071	48.322	55.573	62.824
1.69	26.791	34.107	41.423	48.739	56.055	63.371
1.70	27.014	34.395	41.776	49.157	56.538	63.919
1.71	27.239	34.685	42.131	49.577	57.024	64.470
1.72	27.463	34.974	42.486	49.998	57.509	65.021
1.73	27.687	35.265	42.842	50.419	57.997	65.574
1.74	27.913	35.556	43.199	50.842	58.485	66.128
1.75	28.138	35.847	43.556	51.265	58.975	66.684
1.76	28.364	36.139	43.914	51.689	59.465	67.240
1.77	28.590	36.432	44.274	52.115	59.957	67.798
1.78	28.817	36.725	44.633	52.541	60.449	68.358
1.79	29.045	37.019	44.994	52.969	60.944	68.919
1.80	29.272	37.314	45.356	53.397	61.439	69.481
1.81	29.500	37.609	45.718	53.827	61.936	70.045
1.82	29.729	37.905	46.081	54.257	62.433	70.610
1.83	29.958	38.201	46.445	54.689	62.932	71.176
1.84	30.187	38.498	46.809	55.121	63.432	71.743
1.85	30.416	38.796	47.175	55.554	63.933	72.312
1.86	30.646	39.094	47.541	55.988	64.435	72.882
1.87	30.877	39.392	47.908	56.423	64.938	73.454
1.88	31.108	39.691	48.275	56.859	65.443	74.027
1.89	31.339	39.991	48.644	57.296	65.949	74.601
1.90	31.571	40.292	49.013	57.734	66.455	75.177
1.91	31.803	40.593	49.383	58.173	66.963	75.753
1.92	32.035	40.894	49.753	58.612	67.472	76.331
1.93	32.267	41.196	50.125	59.053	67.981	76.910
1.94	32.501	41.499	50.497	59.495	68.493	77.491
1.95	32.734	41.802	50.870	59.937	69.005	78.073
1.96	32.968	42.106	51.243	60.381	69.518	78.656
1.97	33.202	42.410	51.617	60.825	70.032	79.240
1.98	33.437	42.715	51.992	61.270	70.548	79.824
1.99	33.672	43.020	52.368	61.716	71.064	80.412
2.00	33.907	43.326	52.745	62.163	71.582	81.001

Table 1.—*Discharge of standard contracted rectangular weirs in cubic feet per second, computed from the formula* $Q = 3.33 (L - .2H) H^{\frac{3}{2}}$. (*See paragraphs* 8 *and* 18.)

Head H, feet	Length of weir L, feet.					Head H, feet	Length of weir L, feet.			
	5.0	6.0	7.0	8.0	9.0		6.0	7.0	8.0	9.0
2.01	43.632	53.122	62.601	72.091	81.580	2.51	72.805	86.047	99.289	112.531
2.02	43.939	53.499	63.060	72.620	82.180	2.52	73.212	86.533	99.854	113.175
2.03	44.247	53.878	63.509	73.141	82.772	2.53	73.625	87.026	100.427	113.828
2.04	44.554	54.257	63.959	73.662	83.365	2.54	74.032	87.512	100.992	114.472
2.05	44.863	54.637	64.411	74.185	83.959	2.55	74.444	88.004	101.564	115.124
2.06	45.172	55.018	64.863	74.709	84.555	2.56	74.856	88.496	102.136	115.776
2.07	45.481	55.399	65.316	75.233	85.151	2.57	75.268	88.988	102.708	116.428
2.08	45.791	55.781	65.770	75.760	85.749	2.58	75.679	89.479	103.279	117.079
2.09	46.104	56.166	66.228	76.290	86.352	2.59	76.090	89.970	103.850	117.730
2.10	46.414	56.548	66.682	76.816	86.950	2.60	76.506	90.467	104.428	118.389
2.11	46.723	56.929	67.135	77.341	87.547	2.61	76.917	90.957	104.999	119.039
2.12	47.037	57.316	67.595	77.874	88.153	2.62	77.332	91.454	105.576	119.698
2.13	47.350	57.702	68.054	78.406	88.758	2.63	77.747	91.950	106.153	120.356
2.14	47.663	58.088	68.513	78.938	89.363	2.64	78.162	92.446	106.730	121.014
2.15	47.976	58.474	68.972	79.470	89.968	2.65	78.527	92.883	107.239	121.595
2.16	48.288	58.859	69.430	80.001	90.572	2.66	78.995	93.443	107.890	122.337
2.17	48.605	59.250	69.895	80.540	91.185	2.67	79.410	93.938	108.466	122.994
2.18	48.917	59.635	70.353	81.071	91.789	2.68	79.829	94.439	109.049	123.659
2.19	49.233	60.025	70.817	81.609	92.401	2.69	80.248	94.940	109.632	124.324
2.20	49.549	60.415	71.281	82.147	93.013	2.70	80.666	95.440	110.214	124.988
2.21	49.865	60.805	71.745	82.685	93.625	2.71	81.084	95.940	110.796	125.652
2.22	50.184	61.199	72.214	83.229	94.244	2.72	81.502	96.440	111.378	126.316
2.23	50.499	61.588	72.677	83.766	94.855	2.73	81.925	96.945	111.967	126.987
2.24	50.819	61.983	73.147	84.311	95.475	2.74	82.341	97.445	112.547	127.651
2.25	51.137	62.376	73.615	84.854	96.093	2.75	82.764	97.950	113.136	128.322
2.26	51.456	62.770	74.084	85.398	96.712	2.76	83.185	98.455	113.723	128.993
2.27	51.774	63.163	74.552	85.941	97.330	2.77	83.607	98.959	114.311	129.663
2.28	52.092	63.556	75.020	86.484	97.948	2.78	84.028	99.463	114.898	130.333
2.29	52.415	63.955	75.495	87.035	98.575	2.79	84.454	99.973	115.492	131.011
2.30	52.732	64.347	75.962	87.577	99.192	2.80	84.875	100.477	116.079	131.681
2.31	53.054	64.745	76.436	88.127	99.818	2.81	85.300	100.986	116.672	132.359
2.32	53.375	65.142	76.909	88.676	100.443	2.82	85.720	101.489	117.258	133.027
2.33	53.696	65.539	77.382	89.225	101.068	2.83	86.145	101.998	117.851	133.704
2.34	54.021	65.941	77.861	89.781	101.701	2.84	86.575	102.513	118.451	134.389
2.35	54.342	66.338	78.334	90.330	102.326	2.85	86.999	103.021	119.043	135.065
2.36	54.667	66.739	78.813	90.885	102.959	2.86	87.423	103.529	119.635	135.741
2.37	54.991	67.141	79.291	91.441	103.591	2.87	87.852	104.043	120.234	136.425
2.38	55.315	67.542	79.769	91.996	104.223	2.88	88.276	104.551	120.826	137.101
2.39	55.639	67.943	80.247	92.551	104.855	2.89	88.704	105.064	121.424	137.784
2.40	55.962	68.343	80.724	93.105	105.486	2.90	89.132	105.577	122.022	138.467
2.41	56.290	68.749	81.208	93.667	106.126	2.91	89.559	106.089	122.619	139.149
2.42	56.613	69.149	81.685	94.221	106.757	2.92	89.992	106.608	123.224	139.840
2.43	56.939	69.553	82.167	94.781	107.395	2.93	90.419	107.120	123.821	140.522
2.44	57.266	69.958	82.650	95.342	108.034	2.94	90.851	107.638	124.425	141.212
2.45	57.593	70.363	83.133	95.903	108.673	2.95	91.277	108.149	125.021	141.893
2.46	57.919	70.767	83.615	96.463	109.311	2.96	91.709	108.667	125.625	142.583
2.47	58.249	71.176	84.103	97.030	109.957	2.97	92.140	109.184	126.228	143.272
2.48	58.575	71.579	84.585	97.589	110.595	2.98	92.571	109.701	126.831	143.961
2.49	58.904	71.988	85.072	98.156	111.240	2.99	93.006	110.223	127.440	144.657
2.50	59.233	72.397	85.559	98.723	111.885	3.00	93.438	110.741	128.044	145.348

Table 1.—*Discharge of standard contracted rectangular weirs in cubic feet per second, computed from the formula* $Q = 3.33 (L - .2H) H^{\frac{3}{2}}$. (*See paragraphs* 8 *and* 18.)

Head H, feet	Length of weir L, feet.			Head H, feet	Length of weir L, feet.		Head H, feet	Length of weir L, feet.
	7.0	8.0	9.0		8.0	9.0		9.0
3.01	111.261	128.650	146.040	**3.51**	159.812	181.710	**4.01**	219.214
3.02	111.737	129.207	146.676	**3.52**	160.451	182.443	**4.02**	219.981
3.03	112.300	129.864	147.427	**3.53**	161.092	183.178	**4.03**	220.750
3.04	112.821	130.471	148.121	**3.54**	161.733	183.912	**4.04**	221.517
3.05	113.343	131.081	148.818	**3.55**	162.373	184.646	**4.05**	222.286
3.06	113.865	131.690	149.514	**3.56**	163.016	185.383	**4.06**	223.055
3.07	114.389	132.301	150.213	**3.57**	163.657	186.118	**4.07**	223.824
3.08	114.912	132.912	150.912	**3.58**	164.301	186.857	**4.08**	224.595
3.09	115.435	133.523	151.610	**3.59**	164.945	187.595	**4.09**	225.341
3.10	115.959	134.134	152.310	**3.60**	165.588	188.333	**4.10**	226.139
3.11	116.484	134.747	153.011	**3.61**	166.233	189.074	**4.11**	226.912
3.12	117.010	135.361	153.713	**3.62**	166.878	189.813	**4.12**	227.684
3.13	117.536	135.976	154.416	**3.63**	167.525	190.555	**4.13**	228.458
3.14	118.064	136.592	155.121	**3.64**	168.171	191.297	**4.14**	229.232
3.15	118.590	137.207	155.824	**3.65**	168.817	192.038	**4.15**	230.006
3.16	119.117	137.823	156.528	**3.66**	169.466	192.782	**4.16**	230.782
3.17	119.646	138.440	157.235	**3.67**	170.113	193.525	**4.17**	231.557
3.18	120.177	139.060	157.944	**3.68**	170.763	194.271	**4.18**	232.333
3.19	120.704	139.677	158.650	**3.69**	171.412	195.016	**4.19**	233.110
3.20	121.234	140.295	159.357	**3.70**	172.061	195.761	**4.20**	233.887
3.21	121.765	140.917	160.068	**3.71**	172.713	196.509	**4.21**	234.667
3.22	122.296	141.537	160.778	**3.72**	173.363	197.256	**4.22**	235.446
3.23	122.827	142.158	161.489	**3.73**	174.014	198.003	**4.23**	236.224
3.24	123.360	142.780	162.201	**3.74**	174.666	198.751	**4.24**	237.005
3.25	123.892	143.402	162.913	**3.75**	175.318	199.500	**4.25**	237.785
3.26	124.425	144.026	163.627	**3.76**	175.972	200.251	**4.26**	238.565
3.27	124.959	144.650	164.341	**3.77**	176.625	201.001	**4.27**	239.348
3.28	125.492	145.273	165.054	**3.78**	177.281	201.754	**4.28**	240.130
3.29	126.027	145.899	165.771	**3.79**	177.934	202.503	**4.29**	240.914
3.30	126.562	146.524	166.486	**3.80**	178.591	203.259	**4.30**	241.698
3.31	127.098	147.151	167.204	**3.81**	179.245	204.010	**4.31**	242.481
3.32	127.634	147.778	167.922	**3.82**	179.902	204.764	**4.32**	243.267
3.33	128.171	148.406	168.642	**3.83**	180.561	205.521	**4.33**	244.053
3.34	128.709	149.035	169.362	**3.84**	181.217	206.274	**4.34**	244.837
3.35	129.245	149.663	170.081	**3.85**	181.874	207.030	**4.35**	245.679
3.36	129.784	150.294	170.803	**3.86**	182.534	207.787	**4.36**	246.411
3.37	130.323	150.924	171.525	**3.87**	183.193	208.545	**4.37**	247.197
3.38	130.863	151.555	172.249	**3.88**	183.852	209.302	**4.38**	247.986
3.39	131.402	152.187	172.972	**3.89**	184.513	210.062	**4.39**	248.774
3.40	131.947	152.825	173.702	**3.90**	185.173	210.821	**4.40**	249.562
3.41	132.482	153.451	174.420	**3.91**	185.834	211.580	**4.41**	250.352
3.42	133.023	154.084	175.146	**3.92**	186.713	212.587	**4.42**	251.141
3.43	133.565	154.719	175.873	**3.93**	187.158	213.101	**4.43**	251.934
3.44	134.107	155.354	176.600	**3.94**	187.821	213.864	**4.44**	252.725
3.45	134.649	155.988	177.327	**3.95**	188.485	214.627	**4.45**	253.516
3.46	135.192	156.624	178.056	**3.96**	189.148	215.389	**4.46**	254.307
3.47	135.735	157.260	178.785	**3.97**	189.813	216.154	**4.47**	255.100
3.48	136.280	157.898	179.516	**3.98**	190.477	216.918	**4.48**	255.859
3.49	136.825	158.536	180.247	**3.99**	191.142	217.682	**4.49**	256.637
3.50	137.368	159.173	180.977	**4.00**	191.808	218.448	**4.50**	257.481

Table 2.—*Discharge of standard Cippoletti and standard suppressed rectangular weirs in cubic feet per second. Values below and to left of heavy line determined experimentally; others computed from the formula* $Q = 3.367\ L\ H^{\frac{3}{2}}$. (*See paragraphs 10, 12 and 19.*)

Head *H*, feet	Length of weir *L*, feet.										
	0.5	**1.0**	**1.5**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**
0.01	0.002	0.003	0.005	0.007	0.010	0.013	0.017	0.020	0.024	0.027	0.030
.02	.005	.010	.014	.019	.029	.038	.048	.057	.067	.076	.086
.03	.009	.018	.026	.035	.053	.070	.087	.105	.123	.140	.157
.04	.013	.027	.040	.054	.081	.108	.135	.162	.189	.215	.242
.05	.019	.038	.057	.075	.113	.151	.188	.226	.263	.301	.339
.06	.025	.050	.074	.099	.148	.198	.247	.297	.346	.396	.445
.07	.031	.062	.093	.125	.187	.249	.312	.374	.437	.499	.561
.08	.038	.076	.114	.152	.229	.305	.381	.457	.533	.609	.686
.09	.045	.091	.136	.182	.273	.364	.455	.545	.636	.727	.818
.10	.053	.107	.160	.213	.319	.426	.532	.639	.745	.852	.958
.11	.061	.123	.184	.246	.369	.491	.614	.737	.860	.983	1.105
.12	.070	.140	.210	.280	.420	.560	.700	.840	.980	1.120	1.259
.13	.079	.158	.237	.316	.473	.631	.789	.947	1.105	1.262	1.420
.14	.088	.176	.265	.353	.529	.705	.882	1.058	1.245	1.411	1.587
.15	.098	.196	.293	.391	.587	.782	.978	1 173	1.369	1.565	1.760
.16	.108	.216	.323	.431	.646	.862	1.077	1.293	1.508	1.724	1.939
.17	.118	.236	.354	.472	.708	.944	1.180	1.416	1.652	1.888	2.124
.18	.129	.257	.386	.514	.771	1.028	1.285	1.543	1.800	2.057	2.314
.19	.139	.279	.418	.558	.837	1.115	1.394	1.673	1.952	2.231	2.509
.20	.151	.301	.452	.602	.903	1.205	1.506	1.807	2.108	2.409	2.710
.21	.162	.324	.486	.648	.972	1.296	1.620	1.944	2.268	2.592	2.916
.22	.174	.347	.521	.695	1.042	1.390	1.737	2.084	2.432	2.779	3.127
.23	.186	.371	.557	.743	1.114	1.485	1.857	2.228	2.599	2.971	3.342
.24	.200	.396	.594	.792	1.187	1.583	1.979	2.375	2.771	3.167	3.563
.25	0.214	.421	.631	.842	1.263	1.683	2.104	2.525	2.946	3.367	3.787
.26	.....	.446	.669	.893	1.339	1.785	2.232	2.678	3.124	3.571	4.017
.27	.....	.472	.709	.945	1.417	1.889	2.362	2.834	3.306	3.779	4.251
.28	.....	.499	.748	.998	1.496	1.995	2.494	2.993	3.492	3.991	4.489
.29	.....	.526	.789	1.051	1.577	2.103	2.629	3.155	3.680	4.206	4.732
.30	.....	.553	.830	1.106	1.660	2.213	2.766	3.319	3.872	4.426	4.979
.31	.....	.581	.872	1.162	1.743	2.324	2.905	3.487	4.068	4.649	5.230
.32	.....	.609	.914	1.219	1.828	2.438	3.047	3.657	4.266	4.875	5.485
.33	.....	.638	.957	1.276	1.915	2.553	3.191	3.829	4.467	5.106	5.744
.34	.....	.667	1.001	1.335	2.002	2.670	3.337	4.005	4.672	5.340	6.007
.35	.....	.697	1.046	1.394	2.091	2.788	3.486	4.183	4.880	5.577	6.274
.36	.....	.727	1.091	1.454	2.182	2.909	3.636	4.363	5.090	5.818	6.545
.37	.....	.758	1.137	1.515	2.273	3.031	3.789	4.546	5.304	6.062	6.819
.38	.....	.789	1.183	1.577	2.366	3.155	3.943	4.732	5.520	6.309	7.098
.39	.....	.820	1.230	1.640	2.460	3.280	4.100	4.920	5.740	6.560	7.380
.40	.....	.852	1.278	1.703	2.555	3.407	4.259	5.110	5.962	6.814	7.665
.41	.....	.884	1.326	1.768	2.651	3.535	4.419	5.303	6.187	7.071	7.955
.42	.....	.916	1.375	1.833	2.749	3.665	4.582	5.498	6.415	7.331	8.247
.43	.....	.949	1.424	1.899	2.848	3.797	4.747	5.696	6.645	7.594	8.544
.44	.....	.983	1.474	1.965	2.948	3.930	4.913	5.896	6.878	7.861	8.843
.45	.....	1.016	1.524	2.033	3.049	4.065	5.081	6.098	7.114	8.130	9.147
.46	.....	1.050	1.575	2.101	3.151	4.201	5.252	6.302	7.353	8.403	9.453
.47	.....	1.085	1.627	2.170	3.254	4.339	5.424	6.509	7.594	8.678	9.763
.48	.....	1.122	1.679	2.239	3.359	4.478	5.598	6.718	7.837	8.957	10.076
.49	.....	1.161	1.732	2.309	3.464	4.619	5.774	6.929	8.083	9.238	10.393
0.50	.....	1.200	1.785	2.381	3.571	4.761	5.951	7.142	8.332	9.522	10.713

Table 2.—*Discharge of standard Cippoletti and standard suppressed rectangular weirs in cubic feet per second. Values below and to left of heavy line determined experimentally; others computed from the formula* $Q = 3.367\ L\ H^{\frac{3}{2}}$. (*See paragraphs* 10, 12 *and* 19.)

Head *H*, feet	Length of weir *L*, feet.								
	1.5	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
0.51	1.839	2.451	3.679	4.905	6.131	7.357	8.583	9.809	11.036
.52	1.894	2.525	3.787	5.050	6.312	7.575	8.837	10.099	11.362
.53	1.949	2.598	3.897	5.196	6.495	7.794	9.093	10.392	11.691
.54	2.004	2.672	4.008	5.344	6.680	8.016	9.352	10.688	12.024
.55	2.060	2.747	4.120	5.493	6.866	8.239	9.613	10.986	12.359
.56	2.116	2.822	4.233	5.643	7.054	8.465	9.876	11.287	12.698
.57	2.173	2.898	4.346	5.795	7.244	8.693	10.142	11.591	13.039
.58	2.231	2.974	4.461	5.948	7.435	8.923	10.410	11.897	13.384
.59	2.289	3.051	4.577	6.103	7.629	9.154	10.680	12.206	13.761
.60	2.347	3.129	4.694	6.259	7.823	9.388	10.953	12.517	14.082
.61	2.406	3.208	4.812	6.416	8.020	9.624	11.228	12.832	14.436
.62	2.465	3.287	4.931	6.574	8.218	9.861	11.505	13.149	14.792
.63	2.525	3.367	5.051	6.734	8.417	10.101	11.784	13.468	15.151
.64	2.586	3.447	5.171	6.895	8.619	10.342	12.066	13.790	15.514
.65	2.646	3.529	5.293	7.057	8.821	10.586	12.350	14.114	15.879
.66	2.708	3.610	5.415	7.221	9.026	10.831	12.636	14.441	16.247
.67	2.769	3.693	5.539	7.385	9.232	11.078	12.924	14.771	16.617
.68	2.832	3.810	5.663	7.551	9.439	11.327	13.215	15.103	16.991
.69	2.894	3.895	5.789	7.719	9.648	11.578	13.507	15.437	17.367
.70	2.958	3.980	5.915	7.887	9.859	11.830	13.802	15.774	17.746
.71	3.021	4.06	6.042	8.057	10.071	12.085	14.099	16.113	18.127
.72	3.085	4.15	6.171	8.227	10.284	12.341	14.398	16.455	18.511
.73	3.150	4.24	6.299	8.399	10.499	12.599	14.699	16.799	18.899
.74	3.215	4.33	6.429	8.573	10.716	12.859	15.002	17.145	19.288
.75	3.280	4.415	6.560	8.747	10.934	13.120	15.307	17.494	19.680
.76	.....	4.51	6.692	8.922	11.153	13.384	15.614	17.845	20.075
.77	.....	4.60	6.824	9.099	11.373	13.649	15.923	18.198	20.473
.78	.....	4.69	6.958	9.277	11.596	13.915	16.235	18.554	20.873
.79	.....	4.78	7.092	9.456	11.820	14.184	16.548	18.912	21.276
.80	.....	4.87	7.227	9.636	12.045	14.454	16.863	19.272	21.681
.81	.....	4.96	7.363	9.817	12.271	14.726	17.180	19.634	22.089
.82	.....	5.05	7.500	10.000	12.499	14.999	17.499	19.999	22.499
.83	.....	5.14	7.637	10.183	12.729	15.275	17.820	20.366	22.912
.84	.....	5.24	7.776	10.368	12.959	15.551	18.143	20.735	23.327
.85	.....	5.34	7.915	10.553	13.192	15.830	18.468	21.107	23.745
.86	.....	5.44	8.055	10.740	13.425	16.110	18.795	21.480	24.165
.87	.....	5.54	8.196	10.928	13.660	16.392	19.124	21.856	24.588
.88	.....	5.64	8.338	11.117	13.896	16.675	19.455	22.234	25.013
.89	.....	5.74	8.480	11.307	14.134	16.960	19.787	22.614	25.441
.90	.....	5.84	8.623	11.498	14.373	17.247	20.122	22.996	25.871
.91	.....	5.94	8.768	11.690	14.613	17.535	20.458	23.380	26.303
.92	.....	6.04	8.913	11.883	14.854	17.825	20.796	23.767	26.738
.93	.....	6.14	9.058	12.078	15.097	18.117	21.136	24.155	27.175
.94	.....	6.25	9.205	12.273	15.341	18.410	21.478	24.546	27.614
.95	.....	6.36	9.352	12.469	15.587	18.704	21.821	24.939	28.056
.96	.....	6.47	9.500	12.667	15.833	19.000	22.167	25.334	28.500
.97	.....	6.58	9.649	12.865	16.081	19.298	22.514	25.731	28.947
.98	.....	6.69	9.799	13.065	16.331	19.597	22.863	26.129	29.396
.99	.....	6.80	9.949	13.265	16.581	19.898	23.214	26.530	29.847
1.00	.....	6.91	10.100	13.467	16.833	20.200	23.567	26.933	30.300

Table 2.—*Discharge of standard Cippoletti and standard suppressed rectangular weirs in cubic feet per second. Values below and to left of heavy line determined experimentally; others computed from the formula* $Q = 3.367\ L\ H^{\frac{3}{2}}$. *(See paragraphs 10, 12 and 19.)*

Head H, feet	Length of weir L, feet.						
	3.0	4.0	5.0	6.0	7.0	8.0	9.0
1.01	10.46	13.671	17.089	20.504	23.921	27.338	30.756
1.02	10.62	13.874	17.343	20.809	24.277	27.745	31.213
1.03	10.78	14.079	17.599	21.116	24.635	28.154	31.674
1.04	10.94	14.284	17.855	21.424	24.995	28.565	32.136
1.05	11.10	14.490	18.113	21.734	25.356	28.978	32.601
1.06	11.26	14.698	18.373	22.045	25.719	29.393	33.067
1.07	11.42	14.907	18.633	22.358	26.084	29.810	33.537
1.08	11.58	15.116	18.895	22.672	26.451	30.229	34.008
1.09	11.74	15.326	19.158	22.987	26.819	30.650	34.481
1.10	11.90	15.538	19.423	23.305	27.189	31.073	34.957
1.11	12.06	15.750	19.688	23.623	27.560	31.497	35.435
1.12	12.22	15.964	19.955	23.943	27.933	31.924	35.915
1.13	12.38	16.178	20.222	24.264	28.308	32.353	36.397
1.14	12.54	16.393	20.491	24.587	28.685	32.783	36.881
1.15	12.71	16.609	20.761	24.911	29.063	33.215	37.367
1.16	12.88	16.826	21.033	25.237	29.443	33.649	37.856
1.17	13.05	17.044	21.305	25.564	29.825	34.085	38.346
1.18	13.22	17.263	21.579	25.893	30.208	34.523	38.839
1.19	13.39	17.483	21.854	26.222	30.593	34.963	39.333
1.20	13.56	17.704	22.130	26.554	30.979	35.405	39.830
1.21	13.73	17.926	22.407	26.888	31.367	35.848	40.329
1.22	13.91	18.149	22.686	27.223	31.757	36.294	40.830
1.23	14.09	18.372	22.965	27.559	32.148	36.741	41.333
1.24	14.27	18.597	23.246	27.895	32.544	37.194	41.843
1.25	14.45	18.822	23.527	28.233	32.939	37.644	42.349
1.26	14.63	19.048	23.811	28.573	33.335	38.097	42.859
1.27	14.81	19.276	24.095	28.913	33.732	38.551	43.370
1.28	14.99	19.504	24.380	29.456	34.132	39.008	43.874
1.29	15.17	19.733	24.666	29.599	34.532	39.466	44.399
1.30	15.35	19.962	24.953	29.944	34.934	39.925	44.915
1.31	15.53	20.154	25.242	30.290	35.339	40.307	45.436
1.32	15.71	20.425	25.531	30.638	35.744	40.850	45.957
1.33	15.89	20.658	25.822	30.986	36.151	41.315	46.480
1.34	16.07	20.891	26.114	31.337	36.560	41.782	47.005
1.35	16.25	21.125	26.407	31.688	36.969	42.250	47.532
1.36	16.44	21.360	26.701	32.041	37.381	42.721	48.061
1.37	16.63	21.596	26.995	32.394	37.793	43.192	48.591
1.38	16.82	21.834	27.292	32.750	38.209	43.667	49.126
1.39	17.01	22.071	27.589	33.121	38.625	44.142	49.660
1.40	17.20	22.310	27.887	33.465	39.043	44.620	50.197
1.41	17.39	22.549	28.187	33.824	39.461	45.098	50.736
1.42	17.58	22.790	28.487	34.184	39.882	45.579	51.277
1.43	17.77	23.031	28.789	34.546	40.304	46.062	51.819
1.44	17.96	23.272	29.091	34.909	40.727	46.545	52.363
1.45	18.15	23.516	29.395	35.273	41.152	47.031	52.910
1.46	18.34	23.759	29.699	35.639	41.579	47.518	53.458
1.47	18.53	24.004	30.005	36.005	42.006	48.007	54.008
1.48	18.72	24.249	30.311	36.374	42.436	48.498	54.561
1.49	18.91	24.495	30.619	36.743	42.867	48.990	55.114
1.50	19.10	24.742	30.928	37.114	43.299	49.485	55.669

Table 2.—*Discharge of standard Cippoletti and standard suppressed rectangular weirs in cubic feet per second, computed from the formula* $Q = 3.367\ L\ H^{\frac{3}{2}}$. (*See paragraphs* 10, 12 *and* 19.)

Head H, feet	Length of weir L, feet.					
	4.0	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**
1.51	24.990	31.238	37.486	43.733	49.981	56.228
1.52	25.239	31.549	37.858	44.168	50.478	56.787
1.53	25.479	31.849	38.219	44.589	50.958	57.328
1.54	25.738	32.173	38.608	45.042	51.477	57.911
1.55	25.990	32.487	38.984	45.482	51.979	58.477
1.56	26.242	32.802	39.362	45.923	52.483	58.944
1.57	26.494	33.118	39.742	46.365	52.989	59.612
1.58	26.748	33.435	40.122	46.809	53.496	60.183
1.59	27.002	33.753	40.504	47.254	54.005	60.755
1.60	27.253	34.066	40.879	47.692	54.506	61.319
1.61	27.513	34.391	41.270	48.148	55.026	61.906
1.62	27.770	34.713	41.655	48.597	55.540	62.483
1.63	28.028	35.035	42.041	49.048	56.055	63.062
1.64	28.286	35.357	42.428	49.500	56.571	63.623
1.65	28.545	35.681	42.817	49.953	57.090	64.226
1.66	28.805	36.006	43.207	50.408	57.610	64.811
1.67	29.066	36.332	43.598	50.865	58.131	65.398
1.68	29.327	36.659	43.991	51.323	58.654	65.986
1.69	29.589	36.987	44.384	51.781	59.178	66.576
1.70	29.852	37.315	44.778	52.241	59.704	67.167
1.71	30.116	37.645	45.174	52.703	60.232	67.761
1.72	30.381	37.976	45.571	53.196	60.762	68.357
1.73	30.646	38.307	45.969	53.631	61.292	68.953
1.74	30.912	38.640	46.368	54.096	61.824	69.552
1.75	31.075	38.969	46.583	54.557	62.150	70.144
1.76	31.446	39.308	47.170	55.031	62.893	70.754
1.77	31.715	39.643	47.572	55.501	63.430	71.358
1.78	31.984	39.980	47.976	55.972	63.968	71.964
1.79	32.254	40.317	48.383	56.445	64.508	72.571
1.80	32.524	40.655	48.787	56.918	65.049	73.180
1.81	32.796	40.995	49.194	57.393	65.592	73.791
1.82	33.068	41.335	49.602	57.869	66.136	74 403
1.83	33.341	41.677	50.012	58.347	66.682	75.018
1.84	33.614	42.018	50.422	58.825	67.229	75.632
1.85	33.889	42.361	50.834	59.306	67.778	76.251
1.86	34.164	42.705	51.247	59.788	68.329	76.870
1.87	34.440	43.050	51.660	60.270	68.880	77.490
1.88	34.717	43.396	52.075	60.754	69.434	78.113
1.89	34.994	43.743	52.491	61.239	69.988	78.737
1.90	35.272	44.091	52.909	61.727	70.545	79.363
1.91	35.551	44.439	53.327	62.215	71.102	79.990
1.92	35.830	44.788	53.746	62.703	71.661	80.618
1.93	36.111	45.139	54.166	63.194	72.222	81.249
1.94	36.392	45.490	54.588	63.686	72.784	81.882
1.95	36.674	45.842	55.010	64.179	72.347	82.516
1.96	36.956	46.195	55.434	64.673	73.912	83.142
1.97	37.239	46.549	55.859	65.169	74.478	83.783
1.98	37.523	46.904	56.285	65.666	75.046	84.427
1.99	37.808	47.260	56.712	66.164	75.616	85.068
2.00	38.094	47.617	57.140	66.664	76.187	85.711

Table 2.—*Discharge of standard Cippoletti and standard suppressed rectangular weirs in cubic feet per second, computed from the formula* $Q = 3.367\ L\ H^{\frac{3}{2}}$. (*See paragraphs* 10, 12 *and* 19.)

Head H, feet	Length of weir L, feet.					Head H, feet	Length of weir L, feet.			
	5.0	6.0	7.0	8.0	9.0		6.0	7.0	8.0	9.0
2.01	47.974	57.569	67.164	76.758	86.353	2.51	80.335	93.724	107.113	120.502
2.02	48.333	57.999	67.665	77.332	86.999	2.52	80.814	94.283	107.752	121.221
2.03	48.692	58.430	68.169	77.907	87.646	2.53	81.299	94.849	108.399	121.949
2.04	49.052	58.862	68.673	78.483	88.294	2.54	81.779	95.409	109.038	122.668
2.05	49.413	59.296	69.179	79.062	88.944	2.55	82.264	95.975	109.686	123.396
2.06	49.775	59.731	69.686	79.641	89.596	2.56	82.749	96.541	110.332	124.123
2.07	50.138	60.166	70.193	80.221	90.248	2.57	83.234	97.107	110.979	124.852
2.08	50.502	60.602	70.703	80.803	90.904	2.58	83.720	97.673	111.626	125.580
2.09	50.869	61.043	71.217	81.390	91.564	2.59	84.205	98.239	112.274	126.308
2.10	51.225	61.470	71.715	81.960	92.205	2.60	84.684	98.798	112.912	127.026
2.11	51.597	61.916	72.236	82.555	92.875	2.61	85.182	99.379	113.576	127.773
2.12	51.966	62.359	72.752	83.146	93.539	2.62	85.673	99.952	114.231	128.510
2.13	52.335	62.803	73.270	83.737	94.204	2.63	86.165	100.526	114.886	129.247
2.14	52.704	63.245	73.786	84.326	94.867	2.64	86.656	101.099	115.554	129.984
2.15	53.073	63.688	74.302	84.917	95.531	2.65	87.093	101.609	116.124	130.639
2.16	53.443	64.131	74.819	85.508	96.197	2.66	87.645	102.253	116.860	131.467
2.17	53.817	64.580	75.343	86.106	96.870	2.67	88.136	102.826	117.515	132.205
2.18	54.185	65.023	75.860	86.697	97.534	2.68	88.627	103.398	118.170	132.941
2.19	54.559	65.471	76.383	87.295	98.207	2.69	89.131	103.986	118.842	133.697
2.20	54.930	65.916	76.902	87.888	98.874	2.70	89.616	104.552	119.488	134.424
2.21	55.307	66.369	77.431	88.492	99.553	2.71	90.127	105.148	120.169	135.190
2.22	55.687	66.764	77.962	89.099	100.237	2.72	90.624	105.728	120.832	135.936
2.23	56.061	67.273	78.485	89.698	100.910	2.73	91.127	106.315	121.503	136.700
2.24	56.440	67.728	79.016	90.304	101.592	2.74	91.625	106.896	122.166	137.437
2.25	56.819	68.183	79.547	90.911	102.275	2.75	92.128	107.483	122.838	138.192
2.26	57.199	68.638	80.078	91.518	102.957	2.76	92.632	108.071	123.510	138.948
2.27	57.577	69.093	80.609	92.124	103.639	2.77	93.136	108.658	124.181	139.703
2.28	57.957	69.548	81.140	92.731	104.323	2.78	93.639	109.245	124.852	140.459
2.29	58.341	70.009	81.677	93.346	105.014	2.79	94.148	109.840	125.531	141.223
2.30	58.715	70.458	82.201	93.944	105.687	2.80	94.644	110.418	126.192	141.966
2.31	59.105	70.925	82.746	94.567	106.388	2.81	95.162	111.022	126.882	142.743
2.32	59.489	71.386	83.284	95.182	107.079	2.82	95.665	111.609	127.554	143.498
2.33	59.873	71.848	83.822	95.797	107.771	2.83	96.175	112.204	128.233	144.262
2.34	60.262	72.314	84.367	96.419	108.472	2.84	96.691	112.806	128.921	145.036
2.35	60.647	72.776	84.835	97.034	109.164	2.85	97.200	113.400	129.600	145.800
2.36	61.035	73.243	85.450	97.657	109.864	2.86	97.709	113.994	130.279	146.564
2.37	61.425	73.710	85.995	98.280	110.565	2.87	98.225	114.596	130.967	147.338
2.38	61.815	74.177	86.540	98.903	111.266	2.88	98.735	115.191	131.646	148.102
2.39	62.203	74.644	87.085	99.526	111.966	2.89	99.251	115.793	132.334	148.876
2.40	62.585	75.102	87.619	100.136	112.653	2.90	99.756	116.382	133.008	149.634
2.41	62.987	75.584	88.182	100.779	113.377	2.91	100.282	116.996	133.710	150.423
2.42	63.377	76.052	88.727	101.402	114.078	2.92	100.804	117.604	134.405	151.205
2.43	63.771	76.525	89.279	102.033	114.787	2.93	101.320	118.206	135.093	151.979
2.44	64.165	76.998	89.831	102.664	115.497	2.94	101.841	118.815	135.788	152.761
2.45	64.559	77.471	90.383	103.295	116.207	2.95	102.357	119.417	136.476	153.535
2.46	64.953	77.944	90.935	103.926	116.916	2.96	102.878	120.025	137.171	154.318
2.47	65.353	78.424	91.494	104.565	117.635	2.97	103.400	120.634	137.867	155.101
2.48	65.747	78.897	92.047	105.196	118.345	2.98	103.922	121.242	138.562	155.883
2.49	66.147	79.376	92.606	105.835	119.045	2.99	104.450	121.858	139.266	156.666
2.50	66.540	79.848	93.156	106.464	119.772	3.00	104.964	122.458	139.952	157.446

Table 2.—*Discharge of standard Cippoletti and standard suppressed rectangular weirs in cubic feet per second, computed from the formula* $Q = 3.367\ L\ H^{\frac{3}{2}}$. (*See paragraphs* 10, 12 *and* 19.)

Head H, feet	Length of weir L, feet.			Head H, feet	Length of weir L, feet.		Head H, feet	Length of weir L, feet.
	7.0	8.0	9.0		8.0	9.0		9.0
3.01	123.082	140.665	158.248	3.51	177.130	199.270	4.01	243.333
3.02	123.649	141.311	158.975	3.52	177.888	200.124	4.02	244.245
3.03	124.309	142.068	159.827	3.53	178.648	200.979	4.03	245.147
3.04	124.925	142.771	160.618	3.54	179.407	201.833	4.04	246.070
3.05	125.643	143.478	161.412	3.55	180.167	202.688	4.05	246.985
3.06	126.160	144.183	162.206	3.56	180.930	203.546	4.06	247.900
3.07	126.780	144.891	163.003	3.57	181.691	204.403	4.07	248.815
3.08	127.400	145.600	163.800	3.58	182.456	205.263	4.08	249.733
3.09	128.020	146.309	164.597	3.59	183.222	206.124	4.09	250.624
3.10	128.632	147.008	165.384	3.60	183.968	206.964	4.10	251.550
3.11	129.264	147.730	166.197	3.61	184.754	207.849	4.11	252.444
3.12	129.889	148.444	166.999	3.62	185.522	208.712	4.12	253.415
3.13	130.514	149.158	167.803	3.63	186.292	209.579	4.13	254.340
3.14	131.141	149.875	168.610	3.64	187.062	210.445	4.14	255.263
3.15	131.767	150.591	169.415	3.65	187.833	211.312	4.15	256.188
3.16	132.394	151.307	170.221	3.66	188.606	212.182	4.16	257.115
3.17	133.023	152.026	171.030	3.67	189.378	213.051	4.17	258.043
3.18	133.655	152.749	171.842	3.68	190.154	213.924	4.18	258.970
3.19	134.285	153.468	172.651	3.69	190.930	214.797	4.19	259.899
3.20	134.904	154.176	173.448	3.70	191.688	215.649	4.20	260.802
3.21	135.550	154.914	174.279	3.71	192.485	216.545	4.21	261.763
3.22	136.184	155.638	175.093	3.72	193.263	217.421	4.22	262.697
3.23	136.819	156.364	175.909	3.73	194.042	218.297	4.23	263.638
3.24	137.455	157.091	176.728	3.74	194.822	219.175	4.24	264.566
3.25	138.091	157.818	177.546	3.75	195.604	220.055	4.25	265.503
3.26	138.729	158.548	178.367	3.76	196.388	220.937	4.26	266.439
3.27	139.369	159.278	179.188	3.77	197.171	221.818	4.27	267.379
3.28	140.007	160.008	180.009	3.78	197.958	222.702	4.28	268.318
3.29	140.648	160.741	180.833	3.79	198.742	223.584	4.29	269.260
3.30	141.274	161.456	181.638	3.80	199.512	224.451	4.30	270.171
3.31	141.933	162.209	182.485	3.81	200.318	225.357	4.31	271.146
3.32	142.576	162.944	183.312	3.82	201.106	226.245	4.32	272.091
3.33	143.221	163.682	184.142	3.83	201.898	227.357	4.33	273.037
3.34	143.868	164.421	184.973	3.84	202.688	228.024	4.34	273.982
3.35	144.514	165.158	185.803	3.85	203.480	228.915	4.35	274.927
3.36	145.162	165.899	186.637	3.86	204.272	229.806	4.36	275.878
3.37	145.810	166.640	187.470	3.87	205.070	230.703	4.37	276.827
3.38	146.460	167.383	188.306	3.88	205.864	231.597	4.38	277.779
3.39	147.111	168.126	189.142	3.89	206.662	232.494	4.39	278.730
3.40	147.749	168.856	189.963	3.90	207.440	233.370	4.40	279.657
3.41	148.414	169.616	190.818	3.91	208.256	234.288	4.41	280.626
3.42	149.067	170.362	191.658	3.92	209.298	235.461	4.42	281.590
3.43	149.722	171.110	192.499	3.93	209.856	236.088	4.43	282.549
3.44	150.377	171.860	193.343	3.94	210.658	236.991	4.44	283.506
3.45	151.033	172.609	194.185	3.95	211.462	237.894	4.45	284.463
3.46	151.690	173.360	195.030	3.96	212.264	238.797	4.46	285.421
3.47	152.348	174.112	195.876	3.97	213.070	239.703	4.47	286.382
3.48	153.007	174.866	196.724	3.98	213.874	240.609	4.48	287.345
3.49	153.667	175.620	197.573	3.99	214.680	241.515	4.49	288.306
3.50	154.315	176.360	198.405	4.00	215.464	242.397	4.50	289.242

Table 3—*Coefficients C to be applied to a discharge taken from Table 1 or 2 for a head, H, to obtain the discharge of the same weir when a velocity of approach, v, exists; computed from the formula,* $C = \frac{Q'}{Q} = \frac{D^{\frac{3}{2}}}{H^{\frac{3}{2}}}$. (*See paragraphs* 13 *and* 20.)

v	h	$h^{\frac{3}{2}}$	H											
			0.2	0.4	0.6	0.8	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0
0.4	0.0025	0.0002	1.014	1.007	1.004	1.004	1.004	1.002	1.002	1.002	1.001	1.001	1.001	1.001
0.5	.0039	.0003	1.027	1.013	1.009	1.006	1.006	1.004	1.003	1.002	1.002	1.002	1.001	1.001
0.6	.0056	.0005	1.037	1.019	1.013	1.009	1.008	1.005	1.004	1.003	1.003	1.002	1.002	1.002
0.7	.0076	.0007	1.050	1.026	1.017	1.013	1.011	1.007	1.006	1.004	1.004	1.003	1.003	1.002
0.8	.0099	.0010	1.064	1.033	1.022	1.016	1.014	1.009	1.007	1.006	1.005	1.004	1.003	1.003
0.9	.0126	.0014	1.082	1.042	1.029	1.021	1.018	1.012	1.009	1.007	1.006	1.005	1.005	1.004
1.0	.0155	.0019	1.098	1.051	1.034	1.027	1.022	1.015	1.011	1.009	1.007	1.006	1.005	1.005
1.1	.0188	.0025	1.122	1.062	1.041	1.031	1.026	1.017	1.013	1.011	1.009	1.008	1.007	1.006
1.2	.0224	.0033	1.141	1.072	1.049	1.037	1.031	1.021	1.016	1.013	1.011	1.009	1.008	1.007
1.3	.0263	.0041	1.163	1.084	1.057	1.043	1.036	1.024	1.018	1.015	1.012	1.011	1.009	1.008
1.4	.0305	.0051	1.186	1.096	1.066	1.050	1.041	1.028	1.021	1.017	1.014	1.012	1.011	1.010
1.5	.0350	.0064	1.208	1.109	1.075	1.057	1.047	1.032	1.024	1.019	1.016	1.014	1.012	1.011
1.6	.0398	.0079	1.225	1.122	1.084	1.065	1.052	1.035	1.027	1.022	1.018	1.016	1.014	1.012
1.7	.0449	.0095	1.254	1.135	1.093	1.071	1.059	1.040	1.031	1.025	1.021	1.018	1.016	1.014
1.8	.0504	.0111	1.277	1.149	1.104	1.080	1.065	1.045	1.034	1.027	1.023	1.020	1.017	1.016
1.9	.0561	.0132	1.308	1.165	1.115	1.089	1.072	1.049	1.038	1.030	1.026	1.022	1.019	1.017
2.0	.0622	.0154	1.335	1.181	1.126	1.097	1.079	1.055	1.042	1.034	1.028	1.025	1.021	1.019
2.1	.0686	.0179	1.363	1.197	1.137	1.106	1.087	1.060	1.046	1.037	1.031	1.027	1.024	1.021
2.2	.0752	.0206	1.391	1.213	1.149	1.118	1.094	1.065	1.050	1.039	1.034	1.029	1.026	1.023
2.3	.0822	.0235	1.420	1.231	1.161	1.124	1.102	1.071	1.054	1.044	1.037	1.032	1.028	1.025
2.4	.0895	.0268	1.449	1.248	1.176	1.134	1.110	1.077	1.059	1.047	1.040	1.034	1.030	1.027
2.5	.0972	.0303	1.480	1.266	1.187	1.145	1.119	1.083	1.063	1.051	1.043	1.037	1.033	1.029
2.6	.1051	.0340	1.511	1.285	1.200	1.155	1.128	1.088	1.068	1.055	1.046	1.040	1.035	1.032
2.7	.1133	.0381	1.542	1.303	1.213	1.166	1.137	1.095	1.073	1.059	1.050	1.043	1.038	1.034
2.8	.1219	.0426	1.573	1.322	1.228	1.178	1.146	1.100	1.078	1.063	1.053	1.046	1.041	1.036
2.9	.1307	.0472	1.606	1.341	1.242	1.189	1.153	1.108	1.083	1.067	1.057	1.049	1.043	1.039
3.0	0.1399	0.0524	1.637	1.361	1.256	1.199	1.165	1.115	1.088	1.072	1.061	1.053	1.046	1.041

Table 4—*Coefficients C' to be applied to a discharge given by Table 1 or 2 for a head H to give discharge of same weir submerged, computed from the formula* $C' = \frac{Q_1}{Q} = \frac{(n\,H)^{\frac{3}{2}}}{H^{\frac{3}{2}}}$. *(See paragraphs* 14 *and* 21.)

$d \div H$ Hundredths / Tenths	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	1.000	1.006	1.009	1.009	1.011	1.011	1.011	1.009	1.009	1.007
.1	1.007	1.005	1.003	1.000	.997	.994	.991	.988	.983	.981
.2	.978	.973	.970	.966	.963	.958	.955	.951	.946	.942
.3	.939	.935	.931	.926	.921	.917	.913	.909	.903	.900
.4	.895	.891	.885	.881	.875	.871	.865	.859	.854	.848
.5	.842	.837	.831	.825	.819	.812	.806	.799	.792	.785
.6	.778	.771	.764	.756	.748	.740	.733	.724	.715	.707
.7	.698	.689	.680	.670	.660	.649	.639	.626	.615	.603
.8	.589	.576	.562	.547	.531	.517	.501	.486	.469	.453
0.9	.435	.416	.396	.375	.351	.323	.293	.255	.209	.144

Table 5.—*Acre-feet equivalent to a given number of second-feet flowing for a given length of time.* (*See paragraph 22.*)

Second-feet	Minutes			Hours					
	15	30	45	1	2	3	4	5	6
0.01	0.00021	0.00041	0.00062	0.00083	0.00165	0.00248	0.00331	0.00413	0.00496
.02	.00041	.00083	.00124	.00165	.00331	.00496	.00661	.00826	.00992
.03	.00062	.00124	.00186	.00248	.00496	.00744	.00992	.01240	.01488
.04	.00083	.00165	.00248	.00331	.00661	.00992	.01322	.01653	.01983
.05	.00103	.00207	.00310	.00413	.00826	.01240	.01653	.02066	.02479
.06	.00124	.00248	.00372	.00496	.00992	.01488	.01983	.02479	.02975
.07	.00145	.00289	.00434	.00579	.01157	.01735	.02314	.02893	.03471
.08	.00165	.00331	.00496	.00661	.01322	.01983	.02645	.03306	.03967
.09	.00186	.00372	.00558	.00744	.01488	.02231	.02975	.03719	.04463
.10	.00207	.00413	.00620	.00826	.01653	.02479	.03306	.04132	.04959
.11	.00227	.00455	.00682	.00909	.01818	.02727	.03636	.04545	.05455
.12	.00248	.00496	.00744	.00992	.01983	.02975	.03967	.04959	.05950
.13	.00269	.00537	.00806	.01074	.02149	.03223	.04297	.05372	.06446
.14	.00289	.00579	.00868	.01157	.02314	.03471	.04628	.05785	.06942
.15	.00310	.00620	.00930	.01240	.02479	.03719	.04959	.06198	.07438
.16	.00331	.00661	.00992	.01322	.02645	.03967	.05289	.06611	.07934
.17	.00351	.00702	.01054	.01405	.02810	.04215	.05620	.07025	.08430
.18	.00372	.00744	.01116	.01488	.02975	.04463	.05950	.07438	.08926
.19	.00393	.00785	.01178	.01570	.03140	.04711	.06281	.07851	.09421
.20	.00413	.00826	.01240	.01653	.03306	.04959	.06611	.08264	.09917
.21	.00434	.00868	.01302	.01735	.03471	.05207	.06942	.08678	.10413
.22	.00455	.00909	.01364	.01818	.03636	.05455	.07273	.09091	.10909
.23	.00475	.00950	.01426	.01901	.03802	.05702	.07603	.09504	.11405
.24	.00496	.00992	.01488	.01983	.03967	.05950	.07934	.09917	.11901
.25	.00517	.01033	.01550	.02066	.04132	.06198	.08264	.10331	.12397
.26	.00537	.01074	.01611	.02149	.04297	.06446	.08595	.10744	.12893
.27	.00558	.01116	.01673	.02231	.04463	.06694	.08926	.11157	.13388
.28	.00579	.01157	.01735	.02314	.04628	.06942	.09256	.11570	.13884
.29	.00599	.01198	.01797	.02397	.04793	.07190	.09587	.11983	.14380
.30	.00620	.01240	.01859	.02479	.04959	.07438	.09917	.12397	.14876
.31	.00640	.01281	.01921	.02562	.05124	.07686	.10248	.12810	.15372
.32	.00661	.01322	.01983	.02645	.05289	.07934	.10579	.13223	.15868
.33	.00682	.01364	.02045	.02727	.05455	.08182	.10909	.13636	.16364
.34	.00702	.01405	.02107	.02810	.05620	.08430	.11240	.14049	.16859
.35	.00723	.01446	.02169	.02893	.05785	.08678	.11570	.14463	.17355
.36	.00744	.01488	.02231	.02975	.05950	.08926	.11901	.14876	.17851
.37	.00764	.01529	.02293	.03058	.06116	.09173	.12231	.15289	.18347
.38	.00785	.01570	.02355	.03140	.06281	.09421	.12562	.15702	.18843
.39	.00806	.01611	.02417	.03223	.06446	.09669	.12893	.16116	.19339
.40	.00826	.01653	.02479	.03306	.06611	.09917	.13223	.16529	.19835
.41	.00847	.01694	.02541	.03388	.06777	.10165	.13554	.16942	.20331
.42	.00868	.01735	.02603	.03471	.06942	.10413	.13884	.17355	.20826
.43	.00888	.01777	.02665	.03554	.07107	.10661	.14215	.17769	.21322
.44	.00909	.01818	.02727	.03636	.07273	.10909	.14545	.18182	.21818
.45	.00930	.01859	.02789	.03719	.07438	.11157	.14876	.18595	.22314
.46	.00950	.01901	.02851	.03802	.07603	.11405	.15207	.19008	.22810
.47	.00971	.01942	.02913	.03884	.07769	.11653	.15537	.19421	.23306
.48	.00992	.01983	.02975	.03967	.07934	.11901	.15868	.19835	.23802
.49	.01012	.02025	.03037	.04049	.08099	.12149	.16198	.20248	.24297
0.50	0.01033	0.02066	0.03099	0.04132	0.08264	0.12397	0.16529	0.20661	0.24793

Table 5.—*Acre-feet equivalent to a given number of second-feet flowing for a given length of time.* (*See paragraph 22.*)

Second-feet	Minutes			Hours					
	15	30	45	1	2	3	4	5	6
0.51	0.01054	0.02107	0.03161	0.04215	0.08430	0.12645	0.16859	0.21074	0.25289
.52	.01074	.02149	.03223	.04297	.08595	.12893	.17190	.21488	.25785
.53	.01095	.02190	.03285	.04380	.08760	.13140	.17521	.21901	.26281
.54	.01116	.02231	.03347	.04463	.08926	.13388	.17851	.22314	.26777
.55	.01136	.02273	.03409	.04545	.09091	.13636	.18182	.22727	.27273
.56	.01157	.02314	.03471	.04628	.09256	.13884	.18512	.23140	.27769
.57	.01178	.02355	.03533	.04711	.09421	.14132	.18843	.23554	.28264
.58	.01198	.02397	.03595	.04793	.09587	.14380	.19173	.23967	.28760
.59	.01219	.02438	.03657	.04876	.09752	.14628	.19504	.24380	.29256
.60	.01240	.02479	.03719	.04959	.09917	.14876	.19835	.24793	.29752
.61	.01260	.02521	.03781	.05041	.10083	.15124	.20165	.25207	.30248
.62	.01281	.02562	.03843	.05124	.10248	.15372	.20496	.25620	.30744
.63	.01302	.02603	.03905	.05207	.10413	.15620	.20826	.26033	.31240
.64	.01322	.02645	.03967	.05289	.10579	.15868	.21157	.26446	.31735
.65	.01343	.02686	.04029	.05372	.10744	.16116	.21488	.26859	.32231
.66	.01364	.02727	.04091	.05455	.10909	.16364	.21818	.27273	.32727
.67	.01384	.02769	.04153	.05537	.11074	.16611	.22149	.27686	.33223
.68	.01405	.02810	.04215	.05620	.11240	.16859	.22479	.28099	.33719
.69	.01426	.02851	.04277	.05702	.11405	.17107	.22810	.28512	.34215
.70	.01446	.02893	.04339	.05785	.11570	.17355	.23140	.28926	.34711
.71	.01467	.02934	.04401	.05868	.11735	.17603	.23478	.29339	.35207
.72	.01488	.02975	.04463	.05950	.11901	.17851	.23802	.29752	.35702
.73	.01508	.03017	.04525	.06033	.12066	.18099	.24132	.30165	.36198
.74	.01529	.03058	.04587	.06116	.12231	.18347	.24463	.30579	.36694
.75	.01550	.03099	.04649	.06198	.12397	.18595	.24793	.30992	.37190
.76	.01570	.03140	.04711	.06281	.12562	.18843	.25124	.31405	.37686
.77	.01591	.03182	.04773	.06364	.12727	.19091	.25455	.31818	.38182
.78	.01611	.03223	.04835	.06446	.12893	.19339	.25785	.32231	.38678
.79	.01632	.03264	.04897	.06529	.13058	.19587	.26116	.32645	.39173
.80	.01653	.03306	.04959	.06611	.13222	.19835	.26446	.33058	.39669
.81	.01673	.03347	.05021	.06694	.13388	.20083	.26777	.33471	.40165
.82	.01694	.03388	.05083	.06777	.13554	.20331	.27107	.33884	.40661
.83	.01715	.03430	.05145	.06859	.13719	.20579	.27438	.34297	.41157
.84	.01735	.03471	.05207	.06942	.13884	.20826	.27769	.34711	.41653
.85	.01756	.03512	.05269	.07025	.14049	.21074	.28099	.35124	.42149
.86	.01777	.03554	.05331	.07107	.14215	.21322	.28430	.35537	.42645
.87	.01797	.03595	.05393	.07190	.14380	.21570	.28760	.35950	.43140
.88	.01818	.03636	.05455	.07273	.14545	.21818	.29091	.36364	.43636
.89	.01839	.03678	.05517	.07355	.14711	.22066	.29421	.36777	.44132
.90	.01859	.03719	.05579	.07438	.14876	.22314	.29752	.37190	.44628
.91	.01880	.03760	.05640	.07521	.15041	.22562	.30083	.37603	.45124
.92	.01901	.03802	.05702	.07603	.15207	.22810	.30413	.38017	.45620
.93	.01921	.03843	.05764	.07686	.15372	.23058	.30744	.38430	.46116
.94	.01942	.03884	.05826	.07769	.15537	.23306	.31074	.38843	.46611
.95	.01963	.03926	.05888	.07851	.15702	.23554	.31405	.39256	.47107
.96	.01983	.03967	.05950	.07934	.15868	.23802	.31735	.39669	.47603
.97	.02004	.04008	.06012	.08017	.16033	.24049	.32066	.40083	.48099
.98	.02025	.04049	.06074	.08099	.16198	.24297	.32397	.40496	.48595
.99	.02045	.04091	.06136	.08182	.16364	.24545	.32727	.40909	.49091
1.00	0.02066	0.04132	0.06198	0.08264	0.16529	0.24793	0.33058	0.41322	0.49587

Table 5.—*Acre-feet equivalent to a given number of second-feet flowing for a given length of time.* (*See paragraph 22.*)

Second-feet	Hours								
	7	8	9	10	11	12	13	14	15
0.01	0.00579	0.00661	0.00744	0.00826	0.00909	0.00992	0.01074	0.01157	0.01240
.02	.01157	.01322	.01488	.01653	.01818	.01983	.02149	.02314	.02479
.03	.01735	.01983	.02231	.02479	.02727	.02975	.03223	.03471	.03719
.04	.02314	.02645	.02975	.03306	.03636	.03967	.04297	.04628	.04959
.05	.02893	.03306	.03719	.04132	.04545	.04959	.05372	.05785	.06198
.06	.03471	.03967	.04463	.04959	.05455	.05950	.06446	.06942	.07438
.07	.04049	.04628	.05207	.05785	.06364	.06942	.07521	.08099	.08678
.08	.04628	.05289	.05950	.06611	.07273	.07934	.08595	.09256	.09917
.09	.05207	.05950	.06694	.07438	.08182	.08926	.09669	.10413	.11157
.10	.05785	.06611	.07438	.08264	.09091	.09917	.10744	.11570	.12397
.11	.06364	.07273	.08182	.09091	.10000	.10909	.11818	.12727	.13636
.12	.06942	.07934	.08926	.09917	.10909	.11901	.12893	.13884	.14876
.13	.07521	.08595	.09669	.10744	.11818	.12893	.13967	.15041	.16116
.14	.08099	.09256	.10413	.11570	.12727	.13884	.15041	.16198	.17355
.15	.08678	.09917	.11157	.12397	.13636	.14876	.16116	.17355	.18595
.16	.09256	.10579	.11901	.13223	.14545	.15868	.17190	.18512	.19835
.17	.09835	.11240	.12645	.14049	.15455	.16859	.18264	.19669	.21074
.18	.10413	.11901	.13388	.14876	.16364	.17851	.19339	.20826	.22314
.19	.10992	.12562	.14132	.15702	.17273	.18843	.20413	.21983	.23554
.20	.11570	.13223	.14876	.16529	.18182	.19835	.21488	.23140	.24793
.21	.12149	.13884	.15620	.17355	.19091	.20826	.22562	.24297	.26033
.22	.12727	.14545	.16364	.18182	.20000	.21818	.23636	.25455	.27273
.23	.13306	.15207	.17107	.19008	.20909	.22810	.24711	.26611	.28512
.24	.13884	.15868	.17851	.19835	.21818	.23802	.25785	.27769	.29752
.25	.14463	.16529	.18595	.20661	.22727	.24793	.26859	.28926	.30992
.26	.15041	.17190	.19339	.21488	.23636	.25785	.27934	.30083	.32231
.27	.15620	.17851	.20083	.22314	.24545	.26777	.29008	.31240	.33471
.28	.16198	.18512	.20826	.23140	.25455	.27769	.30083	.32397	.34711
.29	.16777	.19173	.21570	.23967	.26364	.28760	.31157	.33554	.35950
.30	.17355	.19835	.22314	.24793	.27273	.29752	.32231	.34711	.37190
.31	.17934	.20496	.23058	.25620	.28182	.30744	.33306	.35868	.38430
.32	.18512	.21157	.23802	.26446	.29091	.31735	.34380	.37025	.39669
.33	.19091	.21818	.24545	.27273	.30000	.32727	.35455	.38182	.40909
.34	.19669	.22479	.25289	.28099	.30909	.33719	.36529	.39339	.42149
.35	.20248	.23140	.26033	.28926	.31818	.34711	.37603	.40496	.43388
.36	.20826	.23802	.26777	.29752	.32727	.35702	.38678	.41653	.44628
.37	.21405	.24463	.27521	.30579	.33636	.36694	.39752	.42810	.45868
.38	.21983	.25124	.28264	.31405	.34545	.37686	.40826	.43967	.47107
.39	.22562	.25785	.29008	.32231	.35455	.38678	.41901	.45124	.48347
.40	.23140	.26446	.29752	.33058	.36364	.39669	.42975	.46281	.49587
.41	.23719	.27107	.30496	.33884	.37273	.40661	.44049	.47438	.50826
.42	.24297	.27769	.31240	.34711	.38182	.41653	.45124	.48595	.52066
.43	.24876	.28430	.31983	.35537	.39091	.42645	.46198	.49752	.53306
.44	.25455	.29091	.32727	.36364	.40000	.43636	.47273	.50909	.54545
.45	.26033	.29752	.33471	.37190	.40909	.44628	.48347	.52066	.55785
.46	.26611	.30413	.34215	.38017	.41818	.45620	.49421	.53223	.57025
.47	.27190	.31074	.34959	.38843	.42727	.46611	.50496	.54380	.58264
.48	.27769	.31735	.35702	.39669	.43636	.47603	.51570	.55537	.59504
.49	.28347	.32397	.36446	.40496	.44545	.48595	.52645	.56694	.60744
0.50	0.28926	0.33058	0.37190	0.41322	0.45455	0.49587	0.53719	0.57851	0.61983

Table 5.—*Acre-feet equivalent to a given number of second-feet flowing for a given length of time.* (*See paragraph* 22.)

Second-feet	Hours								
	7	8	9	10	11	12	13	14	15
0.51	0.29504	0.33719	0.37934	0.42149	0.46364	0.50579	0.54793	0.59008	0.63223
.52	.30083	.34380	.38678	.42975	.47273	.51570	.55868	.60165	.64463
.53	.30661	.35041	.39421	.43802	.48182	.52562	.56942	.61322	.65702
.54	.31240	.35702	.40165	.44628	.49091	.53554	.58017	.62479	.66942
.55	.31818	.36364	.40909	.45455	.50000	.54545	.59091	.63636	.68182
.56	.32397	.37025	.41653	.46281	.50909	.55537	.60165	.64793	.69421
.57	.32975	.37686	.42397	.47107	.51818	.56529	.61240	.65950	.70661
.58	.33554	.38347	.43140	.47934	.52727	.57521	.62314	.67107	.71901
.59	.34152	.39008	.43884	.48760	.53636	.58512	.63388	.68264	.73140
.60	.34711	.39669	.44628	.49587	.54545	.59504	.64463	.69421	.74380
.61	.35289	.40331	.45372	.50413	.55455	.60496	.65537	.70579	.75620
.62	.35868	.40992	.46116	.51240	.56364	.61488	.66611	.71735	.76859
.63	.36446	.41653	.46859	.52066	.57273	.62479	.67686	.72893	.78099
.64	.37025	.42314	.47603	.52893	.58182	.63471	.68760	.74049	.79339
.65	.37603	.42975	.48347	.53719	.59091	.64463	.69835	.75207	.80579
.66	.38182	.43636	.49091	.54545	.60000	.65455	.70909	.76364	.81818
.67	.38760	.44297	.49835	.55372	.60909	.66446	.71983	.77521	.83058
.68	.39339	.44959	.50579	.56198	.61818	.67438	.73058	.78678	.84297
.69	.39917	.45620	.51322	.57025	.62727	.68430	.74132	.79835	.85537
.70	.40496	.46281	.52066	.57851	.63636	.69421	.75207	.80992	.86777
.71	.41074	.46942	.52810	.58678	.64545	.70413	.76281	.82149	.88017
.72	.41653	.47603	.53554	.59504	.65455	.71405	.77355	.83306	.89256
.73	.42231	.48264	.54297	.60331	.66364	.72397	.78430	.84463	.90496
.74	.42810	.48926	.55041	.61157	.67273	.73388	.79504	.85620	.91735
.75	.43388	.49587	.55785	.61983	.68182	.74380	.80579	.86777	.92975
.76	.43967	.50248	.56529	.62810	.69091	.75372	.81653	.87934	.94215
.77	.44545	.50909	.57273	.63636	.70000	.76364	.82727	.89091	.95455
.78	.45124	.51570	.58017	.64463	.70909	.77355	.83802	.90248	.96694
.79	.45702	.52231	.58760	.65289	.71818	.78347	.84876	.91405	.97934
.80	.46281	.52893	.59504	.66116	.72727	.79339	.85950	.92562	.99173
.81	.46859	.53554	.60248	.66942	.73636	.80331	.87025	.93719	1.00413
.82	.47438	.54215	.60992	.67769	.74545	.81322	.88099	.94876	1.01653
.83	.48017	.54876	.61735	.68595	.75455	.82314	.89173	.96033	1.02893
.84	.48595	.55537	.62479	.69421	.76364	.83306	.90248	.97190	1.04132
.85	.49173	.56198	.63223	.70248	.77273	.84297	.91322	.98347	1.05372
.86	.49752	.56859	.63967	.71074	.78182	.85289	.92397	.99504	1.06611
.87	.50331	.57521	.64711	.71901	.79091	.86281	.93471	1.00661	1.07851
.88	.50909	.58182	.65455	.72727	.80000	.87273	.94545	1.01818	1.09091
.89	.51488	.58843	.66198	.73554	.80909	.88264	.95620	1.02975	1.10331
.90	.52066	.59504	.66942	.74380	.81818	.89256	.96694	1.04132	1.11570
.91	.52645	.60165	.67686	.75207	.82727	.90248	.97769	1.05289	1.12810
.92	.53223	.60826	.68430	.76033	.83636	.91240	.98843	1.06446	1.14049
.93	.53802	.61488	.69173	.76859	.84545	.92231	.99917	1.07603	1.15289
.94	.54380	.62149	.69917	.77686	.85455	.93223	1.00992	1.08760	1.16529
.95	.54959	.62810	.70661	.78512	.86364	.94215	1.02066	1.09917	1.17769
.96	.55537	.63471	.71405	.79339	.87273	.95207	1.03140	1.11074	1.19008
.97	.56116	.64132	.72149	.80165	.88182	.96198	1.04215	1.12231	1.20248
.98	.56694	.64793	.72893	.80992	.89091	.97190	1.05289	1.13388	1.21488
.99	.57273	.65455	.73636	.81818	.90000	.98182	1.06364	1.14545	1.22727
1.00	0.57851	0.66116	0.74380	0.82645	0.90900	0.99173	1.07438	1.15702	1.23967

Table 5.—*Acre-feet equivalent to a given number of second-feet flowing for a given length of time.* (*See paragraph* 22.)

Second-feet	Hours								
	16	17	18	19	20	21	22	23	24
0.01	0.01322	0.01405	0.01488	0.01570	0.01653	0.01735	0.01818	0.01901	0.01983
.02	.02645	.02810	.02975	.03140	.03306	.03471	.03636	.03802	.03967
.03	.03967	.04215	.04463	.04711	.04959	.05207	.05455	.05702	.05950
.04	.05289	.05620	.05950	.06281	.06611	.06942	.07273	.07603	.07934
.05	.06611	.07025	.07438	.07851	.08264	.08678	.09091	.09504	.09917
.06	.07934	.08430	.08926	.09421	.09917	.10413	.10909	.11405	.11901
.07	.09256	.09835	.10413	.10992	.11570	.12149	.12727	.13306	.13884
.08	.10579	.11240	.11901	.12562	.13223	.13884	.14545	.15207	.15868
.09	.11901	.12645	.13388	.14132	.14876	.15620	.16364	.17107	.17851
.10	.13223	.14049	.14876	.15702	.16529	.17355	.18182	.19008	.19835
.11	.14545	.15455	.16364	.17273	.18182	.19091	.20000	.20909	.21818
.12	.15868	.16859	.17851	.18843	.19835	.20826	.21818	.22810	.23802
.13	.17190	.18264	.19339	.20413	.21488	.22562	.23636	.24711	.25785
.14	.18512	.19669	.20826	.21983	.23140	.24297	.25455	.26611	.27769
.15	.19835	.21074	.22314	.23554	.24793	.26033	.27273	.28512	.29752
.16	.21157	.22479	.23802	.25124	.26446	.27769	.29091	.30413	.31735
.17	.22479	.23884	.25289	.26694	.28099	.29504	.30909	.32314	.33719
.18	.23802	.25289	.26777	.28264	.29752	.31240	.32727	.34215	.35702
.19	.25124	.26694	.28264	.29835	.31405	.32975	.34545	.36116	.37686
.20	.26446	.28099	.29752	.31405	.33058	.34711	.36364	.38017	.39669
.21	.27769	.29504	.31240	.32975	.34711	.36446	.38182	.39917	.41653
.22	.29091	.30909	.32727	.34545	.36364	.38182	.40000	.41818	.43636
.23	.30413	.32314	.34215	.36116	.38017	.39917	.41818	.43719	.45620
.24	.31735	.33719	.35702	.37686	.39669	.41653	.43636	.45620	.47603
.25	.33058	.35124	.37190	.39256	.41322	.43388	.45455	.47521	.49587
.26	.34380	.36529	.38678	.40826	.42975	.45124	.47273	.49421	.51570
.27	.35702	.37934	.40165	.42397	.44628	.46859	.49091	.51322	.53554
.28	.37025	.39339	.41653	.43967	.46281	.48595	.50909	.53223	.55537
.29	.38347	.40744	.43140	.45537	.47934	.50331	.52727	.55124	.57521
.30	.39669	.42149	.44628	.47107	.49587	.52066	.54545	.57025	.59504
.31	.40992	.43554	.46116	.48678	.51240	.53802	.56364	.58926	.61488
.32	.42314	.44959	.47603	.50248	.52893	.55537	.58182	.60826	.63471
.33	.43636	.46364	.49091	.51818	.54545	.57273	.60000	.62727	.65455
.34	.44959	.47769	.50579	.53388	.56198	.59008	.61818	.64628	.67438
.35	.46281	.49173	.52066	.54959	.57851	.60744	.63636	.66529	.69421
.36	.47603	.50579	.53554	.56529	.59504	.62479	.65455	.68430	.71405
.37	.48926	.51983	.55041	.58099	.61157	.64215	.67273	.70331	.73388
.38	.50248	.53388	.56529	.59669	.62810	.65950	.69091	.72231	.75372
.39	.51570	.54793	.58017	.61240	.64463	.67686	.70909	.74132	.77355
.40	.52893	.56198	.59504	.62810	.66116	.69421	.72727	.76033	.79339
.41	.54215	.57603	.60992	.64380	.67769	.71157	.74545	.77934	.81322
.42	.55537	.59008	.62479	.65950	.69421	.72893	.76364	.79835	.83306
.43	.56859	.60413	.63967	.67521	.71074	.74628	.78182	.81735	.85289
.44	.58182	.61818	.65455	.69091	.72727	.76364	.80000	.83636	.87273
.45	.59504	.63223	.66942	.70661	.74380	.78099	.81818	.85537	.89256
.46	.60826	.64628	.68430	.72231	.76033	.79835	.83636	.87438	.91240
.47	.62149	.66033	.69917	.73802	.77686	.81570	.85455	.89339	.93223
.48	.63471	.67438	.71405	.75372	.79339	.83306	.87273	.91240	.95207
.49	.64793	.68843	.72893	.76942	.80992	.85041	.89091	.93140	.97190
0.50	0.66116	0.70248	0.74380	0.78512	0.82645	0.86777	0.90909	0.95041	0.99173

Table 5.—*Acre-feet equivalent to a given number of second-feet flowing for a given length of time.* (*See paragraph 22.*)

Second-feet	Hours								
	16	17	18	19	20	21	22	23	24
0.51	0.67488	0.71653	0.75868	0.80083	0.84297	0.88512	0.92727	0.96942	1.01157
.52	.68760	.73058	.77355	.81653	.85950	.90248	.94545	.98843	1.03140
.53	.70083	.74463	.78843	.83223	.87603	.91983	.96364	1.00744	1.05124
.54	.71405	.75868	.80331	.84793	.89256	.93719	.98182	1.02645	1.07107
.55	.72727	.77273	.81818	.86364	.90909	.95455	1.00000	1.04545	1.09091
.56	.74049	.78678	.83306	.87934	.92562	.97190	1.01818	1.06446	1.11074
.57	.75372	.80083	.84793	.89504	.94215	.98926	1.03636	1.08347	1.13058
.58	.76694	.81487	.86281	.91074	.95868	1.00661	1.05455	1.10248	1.15041
.59	.78017	.82893	.87769	.92645	.97521	1.02397	1.07273	1.12149	1.17025
.60	.79339	.84297	.89256	.94215	.99173	1.04132	1.09091	1.14049	1.19008
.61	.80661	.85702	.90744	.95785	1.00826	1.05868	1.10909	1.15950	1.20992
.62	.81983	.87107	.92231	.97355	1.02479	1.07603	1.12727	1.17851	1.22975
.63	.83306	.88512	.93719	.98926	1.04132	1.09339	1.14545	1.19752	1.24959
.64	.84628	.89917	.95207	1.00496	1.05785	1.11074	1.16364	1.21653	1.26942
.65	.85950	.91322	.96694	1.02066	1.07438	1.12810	1.18182	1.23554	1.28926
.66	.87273	.92727	.98182	1.03636	1.09091	1.14545	1.20000	1.25455	1.30909
.67	.88595	.94132	.99669	1.05207	1.10744	1.16281	1.21818	1.27355	1.32893
.68	.89917	.95537	1.01157	1.06777	1.12397	1.18017	1.23636	1.29256	1.34876
.69	.91240	.96942	1.02645	1.08347	1.14049	1.19752	1.25455	1.31157	1.36859
.70	.92562	.98347	1.04132	1.09917	1.15702	1.21487	1.27273	1.33058	1.38843
.71	.93884	.99752	1.05620	1.11488	1.17355	1.23223	1.29091	1.34959	1.40826
.72	.95207	1.01157	1.07107	1.13058	1.19008	1.24959	1.30909	1.36859	1.42810
.73	.96529	1.02567	1.08595	1.14628	1.20661	1.26694	1.32727	1.38760	1.44793
.74	.97851	1.03967	1.10083	1.16198	1.22314	1.28430	1.34545	1.40661	1.46777
.75	.99173	1.05372	1.11570	1.17769	1.23967	1.30165	1.36364	1.42562	1.48760
.76	1.00496	1.06777	1.13058	1.19339	1.25620	1.31901	1.38182	1.44463	1.50744
.77	1.01818	1.08182	1.14545	1.20909	1.27273	1.33636	1.40000	1.46364	1.52727
.78	1.03140	1.09587	1.16033	1.22479	1.28926	1.35372	1.41818	1.48264	1.54711
.79	1.04463	1.10992	1.17521	1.24049	1.30579	1.37107	1.43636	1.50165	1.56694
.80	1.05785	1.12397	1.19008	1.25620	1.32231	1.38843	1.45455	1.52066	1.58678
.81	1.07107	1.13802	1.20496	1.27190	1.33884	1.40579	1.47273	1.53967	1.60661
.82	1.08430	1.15207	1.21983	1.28760	1.35537	1.42314	1.49091	1.55868	1.62645
.83	1.09752	1.16611	1.23471	1.30331	1.37190	1.44049	1.50909	1.57769	1.64628
.84	1.11074	1.18017	1.24959	1.31901	1.38843	1.45785	1.52727	1.59670	1.66611
.85	1.12397	1.19421	1.26446	1.33471	1.40496	1.47521	1.54545	1.61570	1.68595
.86	1.13719	1.20826	1.27934	1.35041	1.42149	1.49256	1.56364	1.63471	1.70579
.87	1.15041	1.22231	1.29421	1.36611	1.43802	1.50992	1.58182	1.65372	1.72562
.88	1.16364	1.23636	1.30909	1.38182	1.45455	1.52727	1.60000	1.67273	1.74545
.89	1.17686	1.25041	1.32397	1.39752	1.47107	1.54463	1.61818	1.69173	1.76529
.90	1.19008	1.26446	1.33884	1.41322	1.48760	1.56198	1.63636	1.71074	1.78512
.91	1.20331	1.27851	1.35372	1.42893	1.50413	1.57934	1.65455	1.72975	1.80496
.92	1.21653	1.29256	1.36859	1.44463	1.52066	1.59669	1.67273	1.74876	1.82479
.93	1.22975	1.30661	1.38347	1.46033	1.53719	1.61405	1.69091	1.76777	1.84463
.94	1.24297	1.32066	1.39835	1.47603	1.55372	1.63140	1.70909	1.78678	1.86446
.95	1.25620	1.33471	1.41322	1.49173	1.57025	1.64876	1.72727	1.80578	1.88430
.96	1.26942	1.34876	1.42810	1.50744	1.58678	1.66611	1.74545	1.82479	1.90413
.97	1.28264	1.36281	1.44297	1.52314	1.60331	1.68347	1.76364	1.84380	1.92397
.98	1.29587	1.37686	1.45785	1.53884	1.61983	1.70083	1.78182	1.86281	1.94380
.99	1.30909	1.39091	1.47273	1.55455	1.63636	1.71818	1.80000	1.88182	1.96364
1.00	1.32231	1.40496	1.48760	1.57025	1.65289	1.73554	1.81818	1.90083	1.98347

Table 5.—*Acre-feet equivalent to a given number of second-feet flowing for a given length of time.* (*See paragraph 22.*)

Second-feet	Days of 24 Hours								
	2	3	4	5	6	7	8	9	10
0.01	0.03967	0.05950	0.07934	0.09917	0.11901	0.13884	0.15868	0.17851	0.19835
.02	.07934	.11901	.15868	.19835	.23802	.27769	.31735	.35702	.39669
.03	.11901	.17851	.23802	.29752	.35702	.41653	.47603	.53554	.59504
.04	.15868	.23802	.31735	.39669	.47603	.55537	.63471	.71405	.79339
.05	.19835	.29752	.39669	.49587	.59504	.69421	.79339	.89256	.99173
.06	.23802	.35702	.47603	.59504	.71405	.83306	.95207	1.07107	1.19008
.07	.27769	.41653	.55537	.69421	.83306	.97190	1.11074	1.24959	1.38842
.08	.31735	.47603	.63471	.79339	.95207	1.11074	1.26942	1.42810	1.58678
.09	.35702	.53554	.71405	.89256	1.07107	1.24959	1.42810	1.60661	1.78512
.10	.39669	.59504	.79339	.99173	1.19008	1.38843	1.58678	1.78512	1.98347
.11	.43636	.65455	.87273	1.09091	1.30909	1.52727	1.74545	1.96364	2.18182
.12	.47603	.71405	.95207	1.19008	1.42810	1.66611	1.90413	2.14215	2.38016
.13	.51570	.77355	1.03140	1.28925	1.54711	1.80496	2.02281	2.32066	2.57851
.14	.55537	.83306	1.11074	1.38842	1.66611	1.94380	2.22149	2.49917	2.77686
.15	.59504	.89256	1.19009	1.48760	1.78512	2.08264	2.38017	2.67769	2.97520
.16	.63471	.95207	1.26942	1.58678	1.90413	2.22149	2.53884	2.85620	3.17355
.17	.67438	1.01157	1.34876	1.68595	2.02314	2.36033	2.69752	3.03471	3.37190
.18	.71405	1.07107	1.42810	1.78512	2.14215	2.49917	2.85620	3.21322	3.57025
.19	.75372	1.13058	1.50744	1.88430	2.26116	2.63802	3.01487	3.39173	3.76859
.20	.79339	1.19008	1.58678	1.98347	2.38017	2.77686	3.17355	3.57025	3.96694
.21	.83306	1.24959	1.66611	2.08264	2.49917	2.91570	3.33223	3.74876	4.16529
.22	.87273	1.30909	1.74545	2.18182	2.61818	3.05455	3.49091	3.92727	4.36363
.23	.91240	1.36859	1.82479	2.28099	2.73719	3.19339	3.64959	4.10578	4.56198
.24	.95207	1.42810	1.90413	2.38016	2.85620	3.33223	3.80826	4.28430	4.76033
.25	.99173	1.48760	1.98347	2.47934	2.97521	3.47107	3.96694	4.46281	4.95867
.26	1.03140	1.54711	2.06281	2.57851	3.09421	3.60992	4.12562	4.64132	5.15702
.27	1.07107	1.60661	2.14215	2.67768	3.21322	3.74876	4.28430	4.81983	5.35537
.28	1.11074	1.66611	2.22149	2.77686	3.33223	3.88760	4.44297	4.99835	5.55372
.29	1.15041	1.72562	2.30083	2.87603	3.45124	4.02645	4.60165	5.17686	5.75206
.30	1.19008	1.78512	2.38017	2.97520	3.57025	4.16529	4.76033	5.35537	5.95041
.31	1.22975	1.84463	2.45950	3.07438	3.68925	4.30413	4.91901	5.53388	6.14876
.32	1.26942	1.90413	2.53884	3.17355	3.80826	4.44297	5.07769	5.71240	6.34710
.33	1.30909	1.96364	2.61818	3.27273	3.92727	4.58182	5.23636	5.89091	6.54545
.34	1.34876	2.02314	2.69752	3.37190	4.04628	4.72066	5.39504	6.06942	6.74380
.35	1.38843	2.08264	2.77686	3.47107	4.16529	4.85950	5.55372	6.24793	6.94215
.36	1.42810	2.14215	2.85620	3.57025	4.28430	4.99835	5.71240	6.42645	7.14049
.37	1.46777	2.20165	2.93554	3.66942	4.40331	5.13719	5.87107	6.60496	7.33884
.38	1.50744	2.26116	3.01487	3.76859	4.52231	5.27603	6.02975	6.78347	7.53719
.39	1.54711	2.32066	3.09421	3.86777	4.64132	5.41487	6.18843	6.96198	7.73553
.40	1.58678	2.38017	3.17355	3.96694	4.76033	5.55372	6.34711	7.14049	7.93388
.41	1.62645	2.43967	3.25289	4.06611	4.87934	5.69256	6.50578	7.31901	8.13223
.42	1.66611	2.49917	3.33223	4.16529	4.99835	5.83140	6.66446	7.49752	8.33057
.43	1.70579	2.55868	3.41157	4.26446	5.11735	5.97025	6.82314	7.67603	8.52892
.44	1.74545	2.61818	3.49091	4.36363	5.23636	6.10909	6.98182	7.85455	8.72727
.45	1.78512	2.67769	3.57025	4.46281	5.35537	6.24793	7.14049	8.03305	8.92561
.46	1.82479	2.73719	3.64959	4.56198	5.47438	6.38678	7.29917	8.21157	9.12396
.47	1.86446	2.79669	3.72893	4.66115	5.59339	6.52562	7.45785	8.39008	9.32231
.48	1.90413	2.85620	3.80826	4.76033	5.71240	6.66446	7.61653	8.56859	9.52066
.49	1.94380	2.91570	3.88760	4.85950	5.83140	6.80331	7.77521	8.74711	9.71900
0.50	1.98347	2.97521	3.96694	4.95867	5.95041	6.94215	7.93388	8.92561	9.91735

Table 5.—*Acre-feet equivalent to a given number of second-feet flowing for a given length of time.* (*See paragraph* 22.)

Second-feet	Days of 24 Hours								
	2	3	4	5	6	7	8	9	10
0.51	2.02314	3.03471	4.04628	5.05785	6.06942	7.08099	8.09256	9.10413	10.11570
.52	2.06281	3.09421	4.12562	5.15702	6.18843	7.21983	8.25124	9.28264	10.31404
.53	2.10248	3.15372	4.20496	5.25619	6.30744	7.35868	8.40992	9.46116	10.51939
.54	2.14215	3.21322	4.28430	5.35537	6.42645	7.49752	8.56859	9.63967	10.71074
.55	2.18182	3.27273	4.36364	5.45454	6.54545	7.63636	8.72727	9.81818	10.90909
.56	2.22149	3.33223	4.44297	5.55372	6.66446	7.77521	8.88595	9.99669	11.10743
.57	2.26116	3.39173	4.52231	5.65289	6.78347	7.91405	9.04463	10.17521	11.30578
.58	2.30083	3.45124	4.60165	5.75206	6.90248	8.05289	9.20331	10.35372	11.50413
.59	2.34049	3.51074	4.68099	5.85124	7.02149	8.19173	9.36198	10.53223	11.70247
.60	2.38017	3.57025	4.76033	5.95041	7.14049	8.33058	9.52066	10.71074	11.90082
.61	2.41983	3.62975	4.83967	6.04958	7.25950	8.46942	9.67934	10.88925	12.09917
.62	2.45950	3.68925	4.91901	6.14876	7.37851	8.60826	9.83802	11.06777	12.29751
.63	2.49917	3.74876	4.99835	6.24793	7.49752	8.74711	9.99669	11.24628	12.49586
.64	2.53884	3.80826	5.07769	6.34710	7.61653	8.88595	10.15537	11.42479	12.69421
.65	2.57851	3.86777	5.15702	6.44628	7.73554	9.02479	10.31405	11.60331	12.89255
.66	2.61818	3.92727	5.23636	6.54545	7.85455	9.16364	10.47273	11.78182	13.09090
.67	2.65785	3.98678	5.31570	6.64462	7.97355	9.30248	10.63140	11.96033	13.28925
.68	2.69752	4.04628	5.39504	6.74380	8.09256	9.44132	10.79008	12.13884	13.48760
.69	2.73719	4.10578	5.47438	6.84297	8.21157	9.58016	10.94876	12.31735	13.68594
.70	2.77686	4.16529	5.55372	6.94215	8.33058	9.71901	11.10744	12.49587	13.88429
.71	2.81653	4.22479	5.63306	7.04132	8.44959	9.85785	11.26611	12.67438	14.08264
.72	2.85620	4.28430	5.71240	7.14049	8.56859	9.99669	11.42479	12.85289	14.28098
.73	2.89587	4.34380	5.79173	7.23967	8.68760	10.13554	11.58347	13.03140	14.47933
.74	2.93554	4.40331	5.87107	7.33884	8.80661	10.27438	11.74215	13.20992	14.67768
.75	2.97521	4.46281	5.95041	7.43801	8.92562	10.41322	11.90083	13.38843	14.87603
.76	3.01487	4.52231	6.02975	7.53719	9.04463	10.55207	12.05950	13.56694	15.07437
.77	3.05455	4.58182	6.10909	7.63636	9.16364	10.69091	12.21818	13.74545	15.27272
.78	3.09421	4.64132	6.18843	7.73553	9.28264	10.82975	12.37686	13.92397	15.47107
.79	3.13388	4.70083	6.26777	7.83471	9.40165	10.96859	12.53554	14.10248	15.66941
.80	3.17355	4.76033	6.34711	7.93388	9.52066	11.10744	12.69421	14.28099	15.86776
.81	3.21322	4.81983	6.42645	8.03305	9.63967	11.24628	12.85289	14.45950	16.06611
.82	3.25289	4.87934	6.50578	8.13223	9.75868	11.38512	13.01157	14.63801	16.26445
.83	3.29256	4.93884	6.58512	8.23140	9.87769	11.52397	13.17025	14.81653	16.46280
.84	3.33223	4.99835	6.66446	8.33057	9.99669	11.66281	13.32893	14.99504	16.66115
.85	3.37190	5.05785	6.74380	8.42975	10.11570	11.80165	13.48760	15.17355	16.85949
.86	3.41157	5.11735	6.82314	8.52892	10.23471	11.94049	13.64628	15.35207	17.05784
.87	3.45124	5.17686	6.90248	8.62809	10.35372	12.07934	13.80496	15.53058	17.25619
.88	3.49091	5.23636	6.98182	8.72727	10.47273	12.21818	13.96363	15.70909	17.45454
.89	3.53058	5.29587	7.06116	8.82644	10.59173	12.35702	14.12231	15.88760	17.65288
.90	3.57025	5.35537	7.14049	8.92561	10.71074	12.49587	14.28099	16.06611	17.85123
.91	3.60992	5.41487	7.21983	9.02479	10.82975	12.63471	14.43967	16.24463	18.04958
.92	3.64959	5.47438	7.29917	9.12396	10.94876	12.77355	14.59835	16.42314	18.24792
.93	3.68925	5.53388	7.37851	9.22313	11.06777	12.91240	14.75702	16.60165	18.44627
.94	3.72893	5.59339	7.45785	9.32231	11.18678	13.05124	14.91570	16.78016	18.64462
.95	3.76859	5.65289	7.53719	9.42148	11.30578	13.19008	15.07438	16.95868	18.84297
.96	3.80826	5.71240	7.61653	9.52066	11.42479	13.32893	15.23306	17.13719	19.04131
.97	3.84793	5.77190	7.69587	9.61983	11.54380	13.46777	15.39173	17.31570	19.23966
.98	3.88760	5.83140	7.77521	9.71900	11.66281	13.60661	15.55041	17.49421	19.43801
.99	3.92727	5.89091	7.85455	9.81818	11.78182	13.74545	15.70909	17.67273	19.63635
1.00	3.96694	5.95041	7.93388	9.91735	11.90083	13.88430	15.86777	17.85124	19.83470

Table 6.—*Discharge of standard submerged rectangular orifices in cubic feet per second, computed from the formula* $Q = 0.61\sqrt{2gH}\,A$. (*See paragraphs* 28 *and* 34.)

Head H, feet.	Cross-sectional area A of orifice, square feet.							
	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0
0.01	0.122	0.245	0.367	0.489	0.611	0.734	0.856	0.978
.02	0.173	0.346	0.518	0.691	0.864	1.037	1.210	1.382
.03	0.212	0.424	0.635	0.847	1.059	1.271	1.483	1.694
.04	0.245	0.489	0.734	0.978	1.223	1.468	1.712	1.957
.05	0.273	0.547	0.820	1.093	1.367	1.640	1.913	2.186
.06	0.300	0.599	0.899	1.198	1.497	1.797	2.097	2.396
.07	0.324	0.647	0.971	1.294	1.617	1.941	2.265	2.588
.08	0.346	0.691	1.037	1.383	1.729	2.074	2.420	2.766
.09	0.367	0.734	1.101	1.468	1.835	2.201	2.638	2.935
.10	0.387	0.773	1.160	1.557	1.933	2.320	2.707	3.094
.11	0.406	0.811	1.217	1.622	2.027	2.433	2.839	3.244
.12	0.424	0.847	1.271	1.694	2.118	2.542	2.965	3.389
.13	0.441	0.882	1.323	1.764	2.205	2.645	3.086	3.527
.14	0.458	0.915	1.373	1.830	2.287	2.745	3.203	3.660
.15	0.474	0.947	1.421	1.895	2.369	2.842	3.316	3.790
.16	0.489	0.978	1.467	1.956	2.445	2.934	3.423	3.912
.17	0.504	1.008	1.512	2.016	2.520	3.024	3.528	4.032
.18	0.519	1.037	1.556	2.075	2.593	3.112	3.631	4.150
.19	0.533	1.066	1.599	2.132	2.665	3.198	3.731	4.264
.20	0.547	1.094	1.641	2.188	2.735	3.282	3.829	4.376
.21	0.561	1.120	1.681	2.241	2.801	3.361	3.921	4.482
.22	0.574	1.148	1.722	2.296	2.870	3.464	4.018	4.592
.23	0.587	1.172	1.759	2.345	2.931	3.517	4.103	4.690
.24	0.600	1.198	1.797	2.396	2.995	3.599	4.193	4.792
.25	0.612	1.223	1.834	2.446	3.057	3.668	4.280	4.891
.26	0.624	1.247	1.871	2.494	3.117	3.741	4.365	4.988
.27	0.636	1.270	1.906	2.541	3.176	3.811	4.446	5.082
.28	0.646	1.294	1.942	2.589	3.236	3.883	4.530	5.178
.29	0.659	1.319	1.978	2.638	3.297	3.956	4.616	5.276
.30	0.670	1.339	2.009	2.678	3.347	4.017	4.687	5.356
.31	0.681	1.363	2.045	2.726	3.407	4.089	4.771	5.452
.32	0.692	1.382	2.073	2.764	3.455	4.146	4.837	5.528
.33	0.703	1.405	2.107	2.810	3.513	4.215	4.917	5.620
.34	0.713	1.426	2.139	2.852	3.565	4.278	4.991	5.704
.35	0.724	1.446	2.169	2.892	3.615	4.338	5.061	5.784
.36	0.734	1.467	2.201	2.934	3.667	4.401	5.135	5.868
.37	0.745	1.488	2.232	2.976	3.720	4.464	5.208	5.952
.38	0.754	1.508	2.262	3.016	3.770	4.524	5.278	6.032
.39	0.764	1.527	2.291	3.054	3.818	4.582	5.345	6.109
0.40	0.774	1.547	2.321	3.094	3.867	4.641	5.415	6.188

Table 6.—*Discharge of standard submerged rectangular orfices in cubic feet per second, computed from the formula* $Q = 0.61 \sqrt{2gH}\, A$. (*See paragraphs* 28 *and* 34.)

Head H, feet.	Cross-sectional area A of orifice, square feet.							
	0.25	**0.5**	**0.75**	**1.0**	**1.25**	**1.5**	**1.75**	**2.0**
0.41	0.783	1.567	2.350	3.133	3.917	4.700	5.483	6.266
.42	0.792	1.585	2.377	3.170	3.962	4.754	5.547	6.339
.43	0.802	1.604	2.406	3.208	4.010	4.812	5.614	6.416
.44	0.811	1.622	2.433	3.244	4.055	4.866	5.677	6.488
.45	0.820	1.640	2.461	3.281	4.101	4.921	5.741	6.562
.46	0.829	1.659	2.489	3.318	4.147	4.977	5.807	6.636
.47	0.839	1.678	2.517	3.356	4.195	5.035	5.874	6.713
.48	0.847	1.695	2.542	3.389	4.237	5.084	5.931	6.778
.49	0.856	1.712	2.568	3.424	4.280	5.136	5.992	6.848
.50	0.865	1.729	2.594	3.458	4.323	5.188	6.052	6.917
.51	0.873	1.746	2.620	3.493	4.366	5.239	6.112	6.986
.52	0.882	1.763	2.645	3.527	4.409	5.290	6.172	7.054
.53	0.890	1.780	2.670	3.560	4.451	5.341	6.231	7.121
.54	0.898	1.797	2.695	3.593	4.491	5.390	6.288	7.186
.55	0.907	1.813	2.719	3.626	4.533	5.439	6.345	7.252
.56	0.915	1.830	2.745	3.660	4.575	5.490	6.405	7.320
.57	0.923	1.846	2.769	3.692	4.615	5.538	6.461	7.384
.58	0.931	1.862	2.794	3.725	4.656	5.587	6.518	7.450
.59	0.939	1.879	2.818	3.757	4.697	5.636	6.575	7.514
.60	0.947	1.895	2.842	3.790	4.737	5.684	6.632	7.579
.61	0.955	1.910	2.865	3.820	4.775	5.730	6.685	7.640
.62	0.963	1.925	2.887	3.850	4.812	5.775	6.737	7.700
.63	0.971	1.941	2.911	3.882	4.853	5.823	6.793	7.764
.64	0.978	1.956	2.934	3.912	4.890	5.868	6.846	7.824
.65	0.986	1.972	2.958	3.944	4.930	5.916	6.902	7.888
.66	0.993	1.987	2.980	3.974	4.967	5.960	6.954	7.947
.67	1.001	2.002	3.003	4.004	5.005	6.006	7.007	8.008
.68	1.008	2.016	3.024	4.032	5.040	6.048	7.056	8.064
.69	1.016	2.032	3.048	4.064	5.080	6.096	7.112	8.128
.70	1.023	2.046	3.069	4.092	5.115	6.138	7.161	8.184
.71	1.031	2.062	3.093	4.124	5.155	6.186	7.217	8.248
.72	1.038	2.076	3.114	4.152	5.190	6.228	7.266	8.304
.73	1.045	2.090	3.135	4.180	5.225	6.270	7.315	8.360
.74	1.052	2.104	3.158	4.210	5.260	6.311	7.369	8.421
.75	1.059	2.118	3.178	4.237	5.296	6.355	7.413	8.475
.76	1.066	2.132	3.198	4.264	5.330	6.396	7.462	8.528
.77	1.072	2.145	3.217	4.290	5.362	6.434	7.507	8.579
.78	1.080	2.160	3.240	4.320	5.400	6.480	7.560	8.640
.79	1.087	2.174	3.261	4.348	5.435	6.522	7.609	8.696
0.80	1.094	2.188	3.282	4.376	5.470	6.564	7.658	8.752

Table 7.—*Coefficients C to be applied to a discharge given by Table 6 to give the discharge of the same orifice suppressed, computed from the formula* $C = 1 + 0.15\ r$.

Size of orifice.			Bottom suppressed.		Bottom and sides suppressed.	
d, feet.	*l*, feet.	*A*, square feet.	*r*	*C*	*r*	*C*
	1.0	0.25	0.40	1.06	0.60	1.09
0.25	2.0	.50	.44	1.07	.56	1.08
	3.0	.75	.46	1.07	.54	1.08
	1.0	.50	.33	1.05	.67	1.10
	1.5	.75	.37	1.06	.63	1.09
0.5	2.0	1.00	.40	1.06	.60	1.09
	2.5	1.25	.42	1.06	.58	1.09
	3.0	1.50	.43	1.06	.57	1.09
	1.33	1.00	.32	1.05	.68	1.10
	1.67	1.25	.34	1.05	.66	1.10
0.75	2.00	1.50	.36	1.05	.64	1.10
	2.33	1.75	.38	1.06	.62	1.09
	2.67	2.00	0.39	1.06	0.61	1.09

Table 8.—*Sample rating table for small Price current meter.*

Time in seconds.	5 Revolutions.		10 Revolutions.		20 Revolutions.		30 Revolutions.		40 Revolutions.		Time in seconds.
	Velocity, ft. per second.	Diff.	Velocity, ft. per second.	Diff.	Velocity, ft. per second.	Diff.	Velocity, ft. per second.	Diff.	Velocity, ft. per second.	Diff.	
40	0.316	.006	0.592	.014	1.14	.03	1.69	.04	2.25	.05	40
41	.310	.006	.578	.013	1.11	.03	1.65	.04	2.20	.05	41
42	.304	.006	.565	.013	1.08	.03	1.61	.04	2.15	.05	42
43	.298	.006	.553	.012	1.06	.02	1.57	.04	2.10	.05	43
44	.293	.005	.542	.011	1.04	.02	1.54	.03	2.05	.05	44
45	.288	.005	.531	.011	1.02	.02	1.51	.03	2.00	.05	45
46	.283	.005	.521	.010	1.00	.02	1.48	.03	1.96	.04	46
47	.278	.005	.511	.010	0.981	.02	1.45	.03	1.92	.04	47
48	.273	.005	.501	.010	.961	.019	1.42	.03	1.88	.04	48
49	.268	.005	.491	.009	.942	.019	1.39	.03	1.84	.04	49
50	.263	.004	.482	.008	.923	.019	1.36	.03	1.80	.04	50
51	.259	.004	.474	.008	.905	.018	1.33	.03	1.77	.03	51
52	.255	.004	.466	.008	.888	.017	1.30	.03	1.74	.03	52
53	.251	.004	.458	.008	.872	.016	1.28	.02	1.71	.03	53
54	.247	.004	.450	.008	.857	.015	1.26	.02	1.68	.03	54
55	.243	.004	.443	.007	.842	.015	1.24	.02	1.65	.03	55
56	.239	.004	.436	.007	.828	.014	1.22	.02	1.62	.03	56
57	.235	.004	.429	.007	.814	.014	1.20	.02	1.59	.03	57
58	.232	.003	.422	.007	.801	.013	1.18	.02	1.56	.03	58
59	.229	.003	.416	.006	.788	.013	1.16	.02	1.53	.03	59
60	0.226	.003	.410	.006	.775	.013	1.14	.02	1.51	.02	60

Time in seconds.	50 Revolutions.		60 Revolutions.		80 Revolutions.		100 Revolutions.		150 Revolutions.		Time in seconds.
	Velocity, ft. per second.	Diff.	Velocity, ft. per second.	Diff.	Velocity, ft. per second.	Diff.	Velocity, ft. per second.	Diff.	Velocity, ft. per second.	Diff.	
40	2.80	.07	3.36	.08	4.47	.11	5.57	.14	8.35	.20	40
41	2.73	.06	3.28	.08	4.36	.10	5.43	.13	8.15	.19	41
42	2.67	.06	3.20	.08	4.26	.10	5.30	.12	7.96	.18	42
43	2.61	.06	3.13	.07	4.16	.10	5.18	.11	7.78	.18	43
44	2.55	.05	3.06	.07	4.06	.09	5.07	.11	7.61	.17	44
45	2.50	.05	2.99	.07	3.97	.08	4.96	.11	7.44	.16	45
46	2.45	.05	2.92	.06	3.89	.08	4.85	.10	7.28	.16	46
47	2.40	.05	2.86	.06	3.81	.08	4.75	.10	7.12	.15	47
48	2.35	.05	2.80	.06	3.73	.08	4.65	.09	6.97	.14	48
49	2.30	.05	2.74	.06	3.65	.08	4.56	.09	6.82	.14	49
50	2.25	.04	2.69	.05	3.58	.07	4.47	.09	6.68	.14	50
51	2.21	.04	2.64	.05	3.51	.07	4.38	.09	6.55	.13	51
52	2.17	.04	2.59	.05	3.45	.06	4.30	.08	6.43	.12	52
53	2.13	.04	2.54	.05	3.39	.06	4.22	.08	6.31	.12	53
54	2.09	.04	2.49	.04	3.33	.06	4.14	.07	6.19	.12	54
55	2.05	.04	2.45	.04	3.27	.06	4.07	.07	6.08	.11	55
56	2.01	.04	2.41	.04	3.21	.06	4.00	.07	5.97	.11	56
57	1.97	.04	2 37	.04	3.15	.06	3.93	.07	5.87	.10	57
58	1.94	.03	2.33	.04	3.09	.05	3.86	.06	5.77	.10	58
59	1.91	.03	2.29	.04	3.04	.05	3.80	.06	5.67	.10	59
60	1.88	.03	2.25	.04	2.99	.05	3.74	.06	5.57	.10	60

Table 9.—*Sample table of current meter notes and computations, by formula* (18), *for U. S. Reclamation Service Power Canal at Spanish Fork, Utah.*

UNITED STATES RECLAMATION SERVICE

Current Meter Notes

Date, Sept. 17, 1909, 10.30 *A. M.; Stream, U. S. R. S. Power Canal; Party, E. S. Fuller; Locality, Spanish Fork, Utah, Meter No.* 400 *Gage height, beg.* 2.80, *end* 2.80, *mean* 2.80. *Total area* 19.0; *Mean velocity,* 5.66; *Discharge,* 107.

Observations.					Computations.						
					Velocity.						
Dist. from initial point	Depth	Depth of observat.	Time in seconds	Revolutions	At point	Mean in vertical	Mean in section	Mean depth	Width	Area	Discharge
4.2	0	Est.	.....	.....	3.49	3.49	.....	.....	.....	.....	.....
5.6	1.4	.8	46.0	100	4.98	4.98	4.24	.7	1.4	0.98	4.2
7.0	2.8	.56	34.4	100	6.64	.....	5.45	2.1	1.4	2.94	16.0
.....	.....	2.24	44.0	100	5.20	5.92	.....	.....	.....	.....	.....
8.0	2.8	.56	35.2	100	6.49	.....	6.10	2.8	1.0	2.80	17.1
.....	.....	2.24	37.8	100	6.05	6.27	.....	.....	.....	.....	.....
9.0	2.8	.56	36.2	100	6.32	.....	6.14	2.8	1.0	2.80	17.2
.....	.....	2.24	40.0	100	5.72	6.02	.....	.....	.....	.....	.....
10.0	2.8	.56	37.4	100	6.12	.....	5.94	2.8	1.0	2.80	16.6
.....	.....	2.24	40.8	100	5.61	5.86	.....	.....	.....	.....	.....
11.0	2.8	.56	38.0	100	6.02	.....	5.75	2.8	1.0	2.80	16.1
.....	.....	2.24	43.4	100	5.27	5.64	.....	.....	.....	.....	.....
12.4	1.4	.8	47.0	100	4.87	4.87	5.26	2.1	1.4	2.94	15.4
13.8	0	Est.	.....	.....	3.41	3.41	4.14	.7	1.4	0.98	4.1
.....	.....	.....	.....	.....	.....	.....	5.62	.....	.....	19.04	106.7

Table 10.—*Sample rating table for U. S. Reclamation Service Power Canal at Spanish Fork, Utah.*

Gage height.	Discharge.	Difference.	Gage height.	Discharge.	Difference.
Feet.	Sec.-ft.	Sec.-ft.	Feet.	Sec.-ft.	Sec.-ft.
0.0	6.0		**2.1**	60.1	
		0.2			5.9
.1	0.2		**.2**	66.0	
		0.5			6.2
.2	0.7		**.3**	72.2	
		0.8			6.5
.3	1.5		**.4**	78.7	
		1.1			6.8
.4	2.6		**.5**	85.5	
		1.4			7.0
.5	4.0		**.6**	92.5	
		1.7			7.2
.6	5.7		**.7**	99.7	
		1.9			7.3
.7	7.6		**.8**	107	
		2.1			8
.8	9.7		**.9**	115	
		2.3			8
.9	12.0		**3.0**	123	
		2.5			8
1.0	14.5		**.1**	131	
		2.7			8
.1	17.2		**.2**	139	
		3.0			9
.2	20.2		**.3**	148	
		3.3			9
.3	23.5		**.4**	157	
		3.5			9
.4	27.0		**.5**	166	
		3.8			9
.5	30.8		**.6**	175	
		4.1			9
.6	34.9		**.7**	184	
		4.4			9
.7	39.3		**.8**	193	
		4.7			9
.8	44.0		**.9**	202	
		5.1			9
.9	49.1		**4.0**	211	
		5.4			
2.0	54.5				
		5.6			

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